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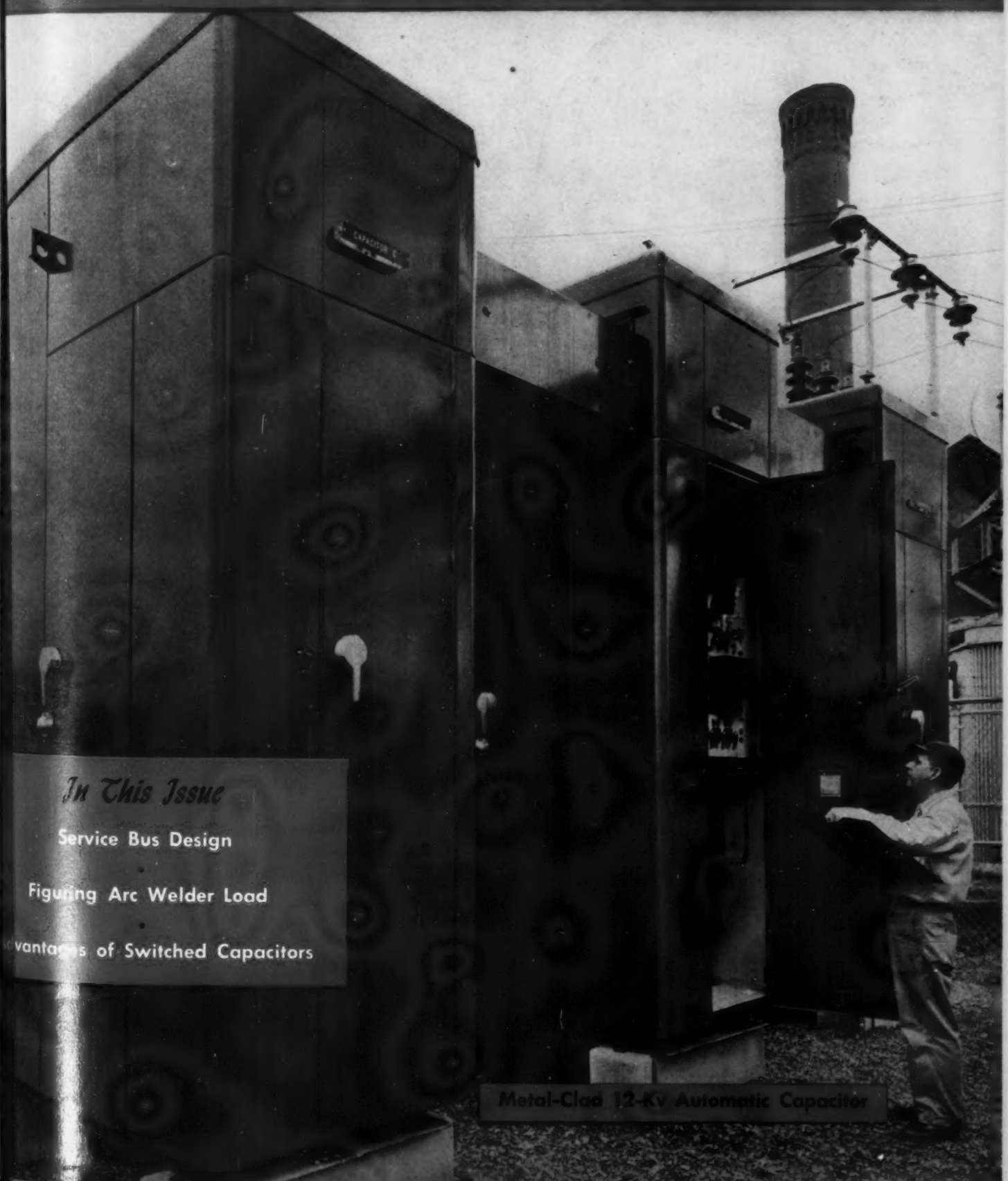
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

DECEMBER 4, 1948



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vantages of Switched Capacitors

Metal-Clad 12-Kv Automatic Capacitor

NEW all-metal WESTON

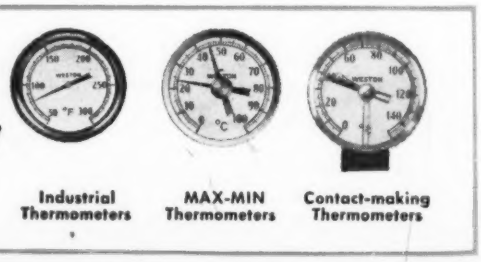
MAGNETIC CONTACT easily set to make contact at any point on scale

This new Weston combines the features of an indicating device with the advantages of an alarm or control instrument. A contact arm, mounted as shown above, is easily set to make contact at any temperature on the scale.

A terminal block on the periphery of the case makes electrical connection easy. The thermometer is all-metal, typically WESTON in ruggedness and reliability, with accuracy of ±1% as an indicating thermometer, and ±1½% as a contact making device. It is supplied in two types—for operation on either increasing or decreasing temperatures.

For complete information see your local WESTON representative or write Weston Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON *Thermometers*



Industrial Thermometers | MAX-MIN Thermometers | Contact-making Thermometers

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Does Public Power Pay?

THE QUESTION "Does Public Power Pay" is raised in the recent publication of the American Public Power Association entitled *"Public Power Pays."* Without a serious analysis of the statistical methods used and the reasons for the differences, it cannot be said that the answer has been given. Similar comparisons were also made in the publication of Burns and McDonnell entitled "Results of Publicly Owned Electric Systems".

Such presentations bring into focus the need for careful analysis of such figures as these comparing items of cost which are probably completely incomparable. Each of these booklets show comparisons which may lead the public to believe that one system is much more efficient than the other.

The managers of federally financed systems, municipals, farmer co-ops, and privately financed systems are all acquainted with the pitfalls of comparing unlike systems within their own category. You immediately find that diesel generated power is more expensive than hydro; that large machines produce power more cheaply than small machines; that underground construction costs are several times those of overhead; and that maintenance in cities is different from maintenance in rural areas.

Statistics honestly arrived at may often be misunderstood.

But the important thing in this case and the important thing for the country as a whole is that an honest endeavor be made by all concerned to keep public thinking clear, not muddy. We have ample evidence from many of those identified with so-called public power systems that fair play is their desire without regard for the major questions of ownership. Such a statement is included in a "letter to the editor" in this issue of ELECTRICAL WORLD from Roy R. Robinson, manager of the Board of Public Works of Niles, Michigan.

We now need a frank and open discussion of the merits of comparison of the two types of electric systems so that those people in the utility industry either public or private become acquainted with the facts. They should know the short comings of such overall industry statistics, the reasons for the differences, and justification for higher unit expenditures.

Obviously a true comparison of things that are substantially different must include proof of the fact that items are incomparable. Certainly the comparison of cost of selling electrically through the time tested methods of newspaper advertising and sales contacts compared with no selling methods at all would still require a dissertation on the value of such expense items to the overall industry economy.

After such facts have been assembled, efforts should be made to see that every branch of the industry is informed. This will not be an easy task, but is one which should be the first order of business. For now the challenge must be met.

Real Public Information

EDITORIAL WRITERS in all branches of the nation's press are going to be delighted with the latest bit of information divulged by the Edison Electric Institute. They will be, that is, to the extent that they see it.

Specifically, they'll be delighted to have a small booklet entitled *The Electric Industry*, published last week. At first glimpse, it looks like another of the promotional jobs which are done so profusely every day, by all manner of people, companies and groups. But this promotional piece, while it is far from novel in the form it takes, certainly does stand out from the viewpoint of information it contains. And it won't be of interest merely to those in and about the electric power business. Its comparisons touch all industries, all farmers, all citizens. Here, in a 32-page booklet, the layman can find all the industry statistics he could possibly want—yet it isn't a statistical bulletin. Here in one booklet, the student or commentator can find all the information as to what's going on in power supply that a layman ordinarily would ask for—yet it's neither a prospectus nor an annual report on the industry. It's a simple, complete and easy-to-read story about the power business which can be used by researchers, editors, students, commentators, speechwriters and anyone else who wants to find out about the power business without immersing himself in the stratosphere of science, engineering, accounting, political science and industrial management. It's a good job and EEI has every reason to be proud of it.

ELECTRICAL WORLD doesn't know whether this booklet is the kick-off of that "expanded and intensified" local public information program which EEI's directors adopted last September at Cleveland. But the booklet fills the bill for such an opening piece.

And since the Cleveland decision was to promote the use locally of material compiled under EEI direction, the hope can be only that local utilities make good use of this booklet. There isn't a high school civics class in the country that couldn't profit by having a copy of this item for each student. Whoever fails to get it onto the city desks and copy desks of every daily paper in his territory is going to be missing a bet. There are almost no members of Congress who are so well-versed in the power business that such a booklet would clutter their offices. It wouldn't be hard to imagine numerous other points to which this booklet should be delivered.

If the privately owned power business wants a local public information program, let it begin here. We haven't seen a better starting place, and we don't expect to.

Industry-Wide Promotion

IS THE electric industry tagging along behind the gas industry in organized promotion of appliances? Can we match the program recently announced for gas range, water heating and year round air conditioning? We understand that the American Gas Association, the Gas Appliance Manufacturers Association, appliance manufacturers and utilities will spend as much as $8,000,000 per year in range promotion. Significant amounts will be spent for other items.

The only comparable activity in the electric utility industry is that of the electric leagues. These organizations, combining all of the important manufacturing, wholesaling, retailing, and utility groups, are supplying an important nucleus for joint promotional activities. Approximately two million dollars per year are being spent through the electric league promotional activities.

There are nearly one hundred of these organizations who are capable of handling a larger load as conditions in the industry permit expansion of sales effort. The human resources of this organization should be given the backing of more financial aid from the utilities. Such backing will pay handsome dividends in good will and better business in the communities which they serve.

Liberalizing Rate Bases

SHOULD LAND PURCHASED far ahead of transmission line construction be included in a rate base? What about water rights obtained several years before a hydro development and real estate bought for future dam sites? One school of opinion in regulative circles holds that until such property enters what might be called the zone of use, rate payers should not support such outlays. Isn't this a bit restricted as to outlook? Suppose the company waits in such buying until the construction period is close at hand. It can easily happen that the property will cost much more than if the directors had taken advantage of the earlier opportunity. It is surprising how land prices tend to rise when the news gets around that a construction job running into large sums is in the wind. Finally, when the outlay is admitted into the rate base the added cost gets a permanent "set". The customers must carry this excess from that time forward.

In land matters the market is not always as stable as the property looks. Sometimes other purchasers enter the picture and as a result engineering changes are forced upon the utility. These may be relocations of routes with costly problems of terrain, longer lines, heavier equipment needs, and unfavorable surroundings. Fluctuating costs are unavoidable, but when good judgment and farsighted management are applied, with no speculative objectives, these steps would seem to partake of rate base legitimacy. Are they not in a sense allied with preliminary engineering activities? They constitute a potential economic reserve in many river developments, for when carried through they increase the efficiency of co-ordinated operation. Each case must be individually judged, but the objectives should tell the regulatory bodies the true story.

NEWS OF THE ELECTRICAL WORLD

The Electrical Week

A study by ELECTRICAL WORLD of the net income and earnings per share of common of 97 utilities has revealed that utilities are making money but not so much as they should if they wish to interest investors in their common stock . . . The billion-dollar federal aid hospital program will bring utilities some good customers, but since many of the hospitals will be in rural areas there will also be some service problems . . . President Truman is forcing the Army Engineers and the Bureau of Reclamation to end their feuding over Pacific Northwest development plans . . . In the South floods caused some trouble by raising tailwaters, but everybody is happy. The South's water problems are over until next spring and maybe even later . . . And energy output last week dropped because of Thanksgiving and, what was more important, the increase over last year was only 7.8%.

Securities and Exchange Commissioner Richard B. McEntire finds increased regulation one antidote for the equity financing troubles of the electric utility industry. "In any event," he told the recent NARUC meeting, "regulatory bodies will be called upon to play much stronger roles in determining the shape of utility financing policies."

Outage time cost a leading eastern utility $1,700,000 in 1947. This high figure was due to persistent difficultics in a new plant and to the difference in generating costs between the unit involved and the less efficient replacement capacity.

Some turbine people suggest that it might be easier to fill ECA requests for electric power equipment by shipping small turbo-generators from this country rather than raw steel. They point out that there is an increasing amount of manufacturing capacity available in this country for machines of under 10,000-kw capacity.

Another Missouri Valley Authority bill will be introduced in the next session of Congress. But it won't get beyond committee hearings next year. Its most ardent advocates concede there is too much local opposition in the West. They're planning an "educational" campaign to wear down this hostility.

Maine's solidly Republican Congressional delegation is backing efforts to revive the Passamaquoddy tidal power project. They won't insist on "Quoddy," however, if they can get other federal aid in easing their state's tight power supply situation.

The basing-point price system has many friends among the country's small manufacturers and wholesalers. A survey of 2,500 members of the National Small Business Men's Association showed almost unanimous agreement in favoring reinstatement of the old system.

Atomic Energy Commission research on nuclear reactors has developed several new metals which were unused up to now because of the difficulty of preparing them but which may become "the structural materials of the future since they show surprisingly good nuclear properties," according to Commissioner Robert F. Bacher.

Science has opened another field of opportunity to the American man. Trained technicians to service television receivers are in short supply.

Increased taxes on business are in the making. Congressional leaders and the administration agree the government will need new revenues in 1950. Both feel it should come from increased corporation taxes. Only difference seems to be over the amount of the new surtax.

Notes From The News

British Columbia Electric Railway Co is exporting up to 500,000 kwhr nightly to the Pacific Northwest. The power is coming from the company's new Bridge River Plant, which has no water storage facilities. In the last two years the United States has been exporting power to British Columbia . . . Lamps of 100 w or larger outsold bulbs of smaller wattage 394,557 to 316,750 in a six-week campaign sponsored by Nashville (Tenn.) Electric Service. Smaller size lamps usually are the more popular . . . Richmond, Va., has lost its three-year battle to force the State Corporation Commission to abandon its method of assessing utility property at 40% of its estimated true market value instead of at a higher value as all other property is assessed. The Virginia Supreme Court of Appeals has upheld the SCC method as constitutional . . . The Department of Commerce has announced

OFFICERS of the new Lima, Ohio Subsection of the American Institute of Electrical Engineers pose with officers of the Dayton Section at the organization meeting. Left to right, front row: C. C. Shutt, Lima; W. R. Appleman, chairman, Dayton Section; L. C. Schaefer, chairman, Lima Subsection; T. J. Martin, secretary, AIEE Section Committee; C. E. Higgins, Dayton Sections Program Committee; J. C. Strasbourger, chairman, AIEE Sections Committee. Rear row: B. O. Austin, director, Lima Subsection; C. G. Veinott, vice-chairman, Dayton Section; B. F. Wyandt, Ohio Society of Professional Engineers; F. C. Horn, vice-chairman, Lima Subsection; O. M. Swain, secretary-treasurer, Lima Subsection; W. A. Dynes, past chairman; L. H. Fox, past secretary; and F. S. Himebrook, past chairman, all of the Dayton Section

a 75% cut in the export quota for United States-produced zinc slabs, pigs, and blocks during the fourth quarter of 1948.

Florida Power Corp has replaced the City of Gainesville as power supplier for the University of Florida because the municipal plant is overloaded . . . An electric power line dipped into the water supply in stalls on an Ontario, Can., farm and electrocuted 18 cattle when they drank . . . Any development of regional or valley authorities constructed along the lines of TVA will meet with strong opposition from the Mississippi Valley Flood Control Association as the result of resolutions passed at its annual convention.

Fishing interests of the Columbia River area, after years of fighting dams which they feared would interfere with fish migration, are now centering their opposition on proposed projects in the lower river . . . Heavy rainfall has made it possible for Toronto, Can., to eliminate the daily 7 to 7:45 P.M. brownout . . . In an unusual accident, a workman repairing a rack deck below turbines at the Canadian Niagara Power Co's Rankin Plant, just above Horseshoe Falls, fell into the water, was swept through a 600-ft tunnel into the Lower Niagara River, and was drowned . . .

Carpenter Steel Co has dedicated its new research laboratory to employees who served in the Armed Forces during World War II . . . Galion, Ohio, tried to serve two manufacturers who needed electric power by granting the Ohio Public Service Co a franchise. Now the city, which has its own municipal plant, has been blocked by an injunction until a referendum can be held . . . Out in Utah, a family had a table model radio which had been out of order for five months. Then a bolt of lightning struck nearby, and now the radio plays as well as when it was new. . . . A new method of making gas from cheaper grades of fuel oil has been announced by the American Gas Association. The advantages are 30% saving in costs and an increase of 35% in thermal capacity of apparatus used.

CONSTRUCTION:

In one recent week Georgia Power Co put into service three generating units with a total capacity of 122,500 kw. The units were one of 22,500 kw at the new Plant Mitchell at Albany, one of 60,000 kw at Plant Atkinson near Atlanta, and one of 40,000 kw at Plant Arkwright near Macon . . . Gulf States Utilities Co will build a $1,000,000 service center at Beaumont, Tex . . . Nantahala Power & Light Co plans to construct a 3,600-kva hydro project on the Tuckasegee River in Jackson County, N. C. . . . Graybar Electric Co will construct a $750,000 office and warehouse in San Francisco . . . Voters of Bonners Ferry, Idaho, have approved a $150,000 bond issue to finance completion of a municipal power dam on the Moyle River. Work on the dam was stopped Oct 20 when proceeds of a $175,000 bond issue were exhausted . . . Union Electric Co of Missouri has bought land in St. Louis to expand its office and service facilities.

FINANCIAL:

Northern Indiana Public Service Co has accepted the bid of Union Securities Corp for the sale of $11,000,000 Series D, first mortgage bonds. The price established by the bid was $100.32 at 3¼% interest, and the bonds will be offered to the public at $100.95 . . . Florida Power Corp has placed on the market an $8,500,000 issue of first mortgage 3¼% bonds due 1978 to yield about 3.2% . . . Missouri Power & Light Co has asked authority from the Missouri Public Service Commission to sell 440,000 shares of $5 par value stock to be bought by the parent corporation, North American Light & Power Co, for $2,200,000 . . . Ohio Edison Co has declared a dividend of $1.10 a share on its 4.4% preferred and of 50¢ a share on common stock.

Utilities Making Money but not Enough

Survey of 97 Electric Companies Reveals Net Income of 56 Up Over 1947 but Recent Sales of Common Stock Have Driven Earnings per Share Down

IN A YEAR when practically every utility is seeking money to finance a construction program, the situation of the utilities as to net income and earnings per share of common stock is important not only to them and their stockholders but also to prospective stockholders.

For the industry as a whole the Federal Power Commission releases a figure each month on the relation of total net income to that for the corresponding month of the previous year. For September, 1948, a 9.2% increase was reported. But because the FPC figure is based on the net income of all companies added together, it is misleading. Of companies showing an increase in net income that month, the range was from 1 to 210%. Naturally a 210% increase is unusual, but it affects FPC's 9.2%.

Reports of 97 Companies Studied

To learn more accurately how the utilities are faring in these days of rising costs as well as of rising load, ELECTRICAL WORLD has made a study of the net income and earnings per common share of 97 companies as reported by *Moody's Public Utilities*, a semi-weekly investors' service. These companies represent 30.89% of the 314 FPC lists as Class A and B electric utilities. In terms of 1947 electric operating revenues, they represent 47.29%.

The study revealed that of the 97 companies, 56 reported an increase in net income for the 12 months ended Sept 30, 1948, over that for the corresponding period of 1947. Percentagewise, the increase was only 0.34% for the entire 97 companies. None lost money, but the net income of 41 companies declined from the previous year.

Earnings Per Share Picture Dark

With respect to earnings per common share, the picture was even darker for the utilities. Only 44 companies reported any increase, 12 below the number that increased net income.

The explanation for this shift is obvious. These twelve were fortunate enough to increase their outstanding common stock during the year. Of 15 other companies which increased their outstanding common, 11 reported a decrease in both net income and earnings per share; four increased both.

In an attempt to discover possible regional trends, a study was made of the location of the companies by FPC regions.

Of the 41 companies showing a decrease in net income, 35 were located in three regions—15 in Region IV, the North Central States; 13 in Region I, the New England and Middle Atlantic States; 7 in Region III, the Southeast States. On the other hand, in Region II, the East Central States, 14 of 15 companies showed increases, and in Region V, the South Central States, 10 of 11. There seems to be no way of explaining these variations without making a close study of the operations of each company. One possible explanatory factor may be an increase in load much greater than that of the other companies. Decreases may be due in part to such factors as a shortage of water for hydro capacity or to damages caused by ice storms, floods, or other disasters.

Grouping of the companies by their total electric operating revenues for 1947 revealed that those with revenues from $10 million plus to $25 million made the best record for net income. In the $20 million plus to $25 million group, all eight companies reported an increase over 1947. Companies in all other groups split half and half on increases and decreases.

Grouping of the companies by FPC regions and by electric operating revenues indicated even less as far as earnings per share went. In both cases, the number of companies reporting increases and the number of those reporting decreases were closer together than in the case of net income.

Comparison of Net Income and Earnings per Share of Utilities, 1947-1948*

BY FPC REGIONS

FPC Region	Net Income Inc.	Net Income Dec.	Earn. per Com. Share Inc.	Earn. per Com. Share Dec.
I	8	13	6	15
II	14	1	10	5
III	3	7	2	8
IV	8	15	5	18
V	10	1	9	2
VI	4	2	4	2
VII	6	1	5	2
VIII	3	1	3	1
Total	56	41	44	53

BY ELECTRIC OPERATING REVENUES

0–5[1]	11	11	9	13
5+210	10	11	8	13
10+215	7	3	6	4
15+220	9	4	7	6
20+225	8	0	5	3
25+230	3	3	2	4
30 Up	8	9	7	10
Total	56	41	44	53

[1] In millions of dollars as reported to FPC for 1947

EFFECT OF NUMBER OF COMMON SHARES ON EARNINGS PER SHARE, 1947–1948*

Electric Oper. Rev.[1]	Equal Shares Inc.	Equal Shares Dec.	More Shares Inc.	More Shares Dec.	Fewer Shares Inc.	Fewer Shares Dec.
0–5	7	10	0	2	2	1
5+210	8	7	0	6	0	0
10+215	6	2	0	2	0	0
15+220	7	3	0	3	0	0
20+225	3	0	2	3	0	0
25+230	2	2	0	2	0	0
30 Up	5	5	2	5	0	0
Total	38	29	4	23	2	1

[1] In millions of dollars as reported to FPC for 1947

* Twelve months to Sept 30

Radiant Highway Heating to Be Tested in Michigan

Electric radiant heating will be used experimentally by the Michigan Highway Department on a short stretch of Highway M-102 west of Ferndale this winter. Engineers will make detailed studies of the system in an attempt to determine its effectiveness in preventing ice and snow formation.

Electrical equipment for the 1,000 ft of test section cost about $2,500, but large-scale installation would be much less expensive, highway department officials said. The equipment is expected to last the life of the pavement, between 20 and 25 years.

This method of winter maintenance may prove to be less expensive than present methods, Charles M. Ziegler, highway commissioner, declared. Under normal winter weather conditions current will flow through the heating elements about 50% of the time. Designed to operate on approximately 50 watts per sq ft of heating element, the entire project will draw 150 kw per hour.

Adding 40,000-Kw Unit

Productive capacity of the New York State Electric & Gas Corp's Greenidge station at Dresden, N. Y., will be doubled when a $1,000,000 addition goes into operation early in 1950. The new 40,000-kw turbo-generator will supplement the plant's two 20,000-kw units and increase total generating capacity to 80,000 kw. The installation will include two steam boilers, each capable of producing 288,000 lb.

RUSSELL STATION tablet gets the attention of executives of the Rochester Gas & Electric Corp following the dedication of the 220,000-kw generating station. Left to right are Edward W. Morehouse, vice-president, General Public Utilities Co; Herman Russell, chairman of the board, for whom the station was named; Edward G. Miner, chairman of the Executive Committee of the utility; and Alexander M. Beebee, corporation president

Utilities to Get Customers, Problems from Federal Aid Hospital Program

CUSTOMERS for the electrical industries are developing with the billion-dollar federal aid hospital program. All of the more than 500 civilian hospitals to be built under the program will be electric utility customers within a few years. The utilities also will get some service problems, since most of the hospitals will be built in non-urban areas where such power loads do not now exist.

Appliance manufacturers and distributors already are receiving orders for hospital equipment, and contractors are bidding, or working, on wiring jobs for the 101 hospitals under construction. Though the U. S. Public Health Service maintains general supervision of the program and the federal funds invested, construction, equipment, and service contracts are awarded by the local groups, which put up two-thirds of the cost of each project.

Approved by Congress in 1946, with a pledge of federal funds at the rate of $75,000,000 a year for five years, the program lagged while the states surveyed their hospital needs. First federal funds became available in July, 1947, but actual construction began rolling only in recent months. Public Health Service now has approved plans for more than 300 new hospitals, for numerous additions to existing hospitals, new clinics, and laboratories.

About two-thirds of the approved hospital projects are planned for communities of less than 10,000 population. Public Health Service sources report the non-urban emphasis of the program is already producing construction problems. Electrical contractors with experienced crews are scarce in such areas, they say. PHS also is concerned over the adequacy of service offered by some rural power suppliers.

Standards for electric service, wiring, and installations at federal aid hospitals were being prepared by Public Health this week as a guide for wiring crews. The wiring specifications follow closely the National Electrical Code, spelling out details for contractors not familiar with it.

The standards recommend lighting designed for "comfortable seeing" throughout every hospital. Lighting intensities should range from 5 Ft-c in corridors, private rooms, and wards to 1,000 Ft-c over major operating tables.

Electric service may be primary or secondary, depending on "load demands and other local conditions." Service conductors into hospitals should be underground where possible. A 3-phase, 4-wire, 120-208-v wiring system was recommended as "cheaper" and having other advantages.

Emergency power may be assured through service from two independent generating plants, from separate transmission lines of a network system, or from storage batteries or a standby generator maintained by the hospital.

The PHS standards recommend electric clock, alarm, and signal systems but calls for no equipment involving a selection between competitive fuels. Unlike the Veterans Administration, whose hospital program bogged down last year in bickering over electric vs gas stoves for kitchens, PHS wants no part of any such argument. Local project sponsors will select kitchen equipment and other optional installations.

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Union Electric Blamed for 1943 Flood Damage

Union Electric Co of Missouri has been held liable for flood damage to private property resulting from conditions created by construction of its hydroelectric reservoir, the Lake of the Ozarks, on the Osage River.

The Missouri Supreme Court affirmed a $600 judgment in one of some 50 suits filed by residents of Benton and Pettis Counties who suffered loss during a heavy flood in May, 1943. Damage claims total approximately $200,000. The decision upheld the theory that waters impounded by Bagnell Dam caused silt deposits in the Osage River and its tributaries which raised the stream beds, retarded flow, and resulted in the flood.

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Knoxville Plans Expansion

A $10,226,000 expansion of electric facilities is planned for the next three years by the Knoxville, Tenn., Utilities Board. The Board has asked the city council to authorize $6,000,000 in bonds to help finance the improvements, with the remainder of the cost to come from earnings. The bonds will be repaid from electric system revenues.

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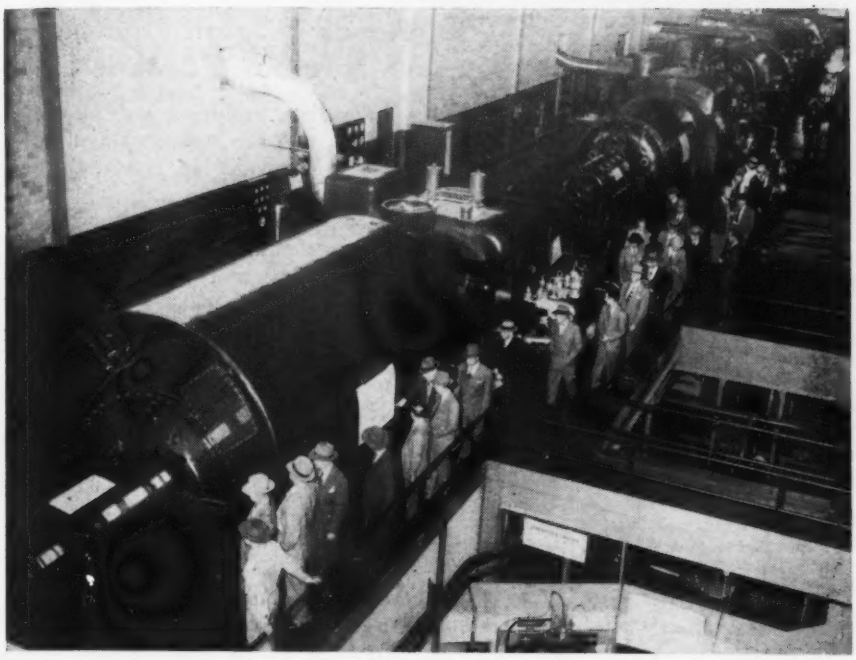
Florida Franchise Given

The City of Leesburg, Fla., has been granted a 20-year franchise to distribute power within the town limits of Fruitland Park. Terms of the franchise, which include a 10-year recapture clause, call for a 10% tax on gross receipts for the first 2 years, 8% for the next 3, and 7% for the remainder of the period.



NEW 30,000-KW UNIT in the Tulsa Plant of the Public Service Co of Oklahoma is inspected by some 200 Rotarians. Utility held Open House for a week to celebrate expansion

Truman Forcing 'Shotgun' Union of Agencies Developing Northwest

A "SHOTGUN" UNION of development agencies in the Pacific Northwest will be consummated before Jan 1. It will produce what will amount to a Columbia Valley Authority in everything but name and outward appearance.

President Truman himself in mid-September ordered the several federal agencies in the region, particularly the Army's Corps of Engineers and Interior's Reclamation Bureau, to settle their regional differences. Since his election victory the President has convinced them he means business.

Field representatives of the Engineers and the Bureau are conducting a series of meetings to coordinate project planning and other details at the operating level. Top level policy negotiations are being carried on in Washington.

Other agencies, including the Federal Power Commission, Agriculture Department, and Bonneville Power Administration, are sitting in on the sessions, since they too have a finger in Northwest programs. But the two big construction agencies, long at odds over who should build what dam and for what purposes, are the key participants. They are expected to reach full agreement in December.

First results probably will be presentation to Congress of a joint Engineers-Reclamation-BPA development program for the Columbia Basin. The President has promised to present the development plan and help obtain necessary authorizations and appropriations.

Preparation of this program, now under way, will mean the burying of such feuds between Reclamation and the Engineers as that over the proposed Hell's Canyon Dam on the Snake River in Idaho. Both agencies want to build the project.

Another source of friction, the Engineers' demands that the Bureau maintain some flood control facilities at certain Reclamation dams, apparently has already been resolved. Recently the Reclamation Bureau announced a change of plans for its $100,000,000 Hungry Horse Dam, being built on Montana's Flathead River. The blueprint alteration provides for a third outlet pipe, with discharge capacity of 4,000 cfs, as a flood control measure.

Incidentally, the Bureau announced the additional outlet would allow "a much greater allocation of construction costs" to flood control—which is non-reimbursable. Result would be a reduction in costs to be repaid from sales of power.

The new emphasis on "regional development" by the two agencies encourages further cooperative planning, with flood control and navigation features being added in Reclamation projects and storage for irrigation at some dams built by the Engineers. A single accounting system, with the revenues from all projects in the area being lumped to meet repayments to the federal treasury, would be the next step. But this would be the hardest "coordination" pill of them all for the Engineers to swallow.

For a time at least there will be no top administrative agency. The Engineers, the Bureau, Bonneville Power, and other federal agencies will continue their construction activities much as at present, though with a higher degree of advance consultation. The Columbia Basin Inter-Agency Committee, a combination of federal agency and state governmental representatives in the area, may be strengthened. Certainly the committee will figure much more prominently as an on-the-spot coordinating body to iron out disagreements.

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New Method of Picking Coffin Winner Announced

A new procedure for selecting the annual winner of the Charles A. Coffin Medal has been announced by the Charles A. Coffin Foundation and the Edison Electric Institute.

Under the new procedure, five companies, to be chosen through a nominating and reviewing process now being established, will be invited by the EEI president to compete for the award. The award committee will select the winner from these five.

Formerly a general invitation to compete was given to all operating companies, leaving the initiative in the hands of the companies.

The nominating panel will consist of the chairmen of 13 EEI committees and six executives of companies which have received the award in the past. Each member will submit the names of three utilities other than his own. A review committee, appointed by the EEI president, will select five of these utilities. These five will then be invited to submit simple presentations, which will be used by the Coffin Award Committee to select the winner.

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Power Contract Signed

Martinsville, Va., City Council has approved a new 10-year contract with the Appalachian Electric Power Co to supply the city's power needs. The new rate is approximately the same as that in the existing contract, which expires this year.

Changes in Capacity Reported to Federal Power Commission

PLANT ADDITIONS DURING OCTOBER

Utility	Plant	Fuel	Capacity (Kw)
Maine Public Service Co	Caribou	IC	5,000
Eastern New York Power Corp	High Falls	H	4,000
Highland Light & Power Department	Highland, Ill.	S	2,000
Wisconsin Electric Power Co	Port Washington	S	80,000
Mora Municipal Utilities	Mora, Minn.	IC	1,245
Northern States Power Co	Wilmarth	S	12,500
Iowa Electric Co	Fairfield	IC	2,000
Bethany Municipal Light & Power Plant	Bethany, Mo.	IC	1,125
Northwestern Public Service Co	Mitchell, S. D.	S	7,500
Girard Municipal Light & Water Department	Girard, Kan.	IC	840
Kansas Power & Light Co	Kinsley	IC	676
Eastern Shore Public Service Co	Oxford, Md.	IC	500
Virginia Electric & Power Co	Chesterfield	IC	200
Duke Power Co	Cliffside, N. C.	S	65,000
Greenwood County Rural Electric System	Greenwood County, S. C.	S	10,000
Rayne Municipal Water & Light Department	Rayne, La.	IC	600
New Orleans Public Service Co, Inc	Ind. Canal St.	S	37,500
Oklahoma Gas & Electric Co	Woodward	IC	891
Ekalaka Light & Power Co	Ekalaka, Mont.	IC	75
California Oregon Power Co	Trinity Center, Calif.	IC	50

PLANT RETIREMENTS DURING OCTOBER

Public Service Co of New Hampshire	Bethlehem	IC	200
Highland Light & Power Department	Highland, Ill.	S	600
South Eastern Michigan Rural Electric Co-op	Adrian	IC	1,158
Border Counties Power Cooperative	Grygla, Minn.	IC	55
Mora Municipal Utilities	Mora, Minn.	IC	186
Border Counties Power Cooperative	Warroad, Minn.	IC	849
Iowa Power & Light Co	Clarinda No. 1	S	250
Bethany Municipal Light & Power Plant	Bethany, Mo.	IC	320
Northwestern Public Service Co	Mitchell, S. D.	S	750
Eastern Shore Public Service Co	Betterton, Md.	IC	148
Virginia Electric & Power Co	Nags Head	IC	200
Rayne Municipal Water & Light Department	Rayne, La.	IC	270
Tucumcari Light & Power Department	Tucumcari, N. Mex.	IC	500
Salt River Valley (Ariz.) Water Users	Malilla Unit	S	10,000
California Oregon Power Co	Happy Camp, Calif.	IC	60

H—Hydro, IC—Internal combustion, S—Steam.
United States Capacity as of Nov. 1—Steam, 37,856,944; Internal Combustion, 1,540,622; Hydro, 15,570,509; Total, 54,968,075.

Texas Electric Doubles Postwar Expansion Plan

Texas Electric Service Co's expansion program in Fort Worth and West Texas has become a $50,000,000 project, almost double the original postwar plan.

Included in the program is installation of 315,000 kw of capacity in eight plants, three of them new, as well as new power lines and other facilities. A second 75,000-kw steam-electric turbine-generator will be installed in Handley Plant in 1952. Capacity of the Permian Basin Plant at Monahans will be doubled to 50,000 kw in 1949. Two 12,500-kw turbine-generator units have been ordered for the Wichita Falls Plant, and a new 40,000-kw steam-electric generating station is to be installed on Morgan Creek to serve Colorado City. Diesel generating plants for Odessa, Snyder, Big Spring, and Sweetwater plants already have been purchased.

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Less Silicon Steel

Future annual production by the United States Steel Corp of silicon steel for use in transformer sheets is expected to approximate 20,000 net tons and of all grades of silicon steel 120,000 net tons, ELECTRICAL WORLD has been informed. A corporation official further predicted that the nation's total production of silicon steel this year will drop to 650,000 from the 682,000 net tons made in 1947 because of the loss of production from the Empire Steel Co. This manufacturer has been absorbed by the Studebaker Corp.

•

FPC Asked to Approve Black River Power Plan

A declaration of intention to develop a power project on the Black River at Glen Park, just west of Watertown, N. Y., has been filed with the Federal Power Commission by Black River Development Corp, New York City.

The proposed project would consist of a 15-ft dam at Glen Park at the site of a previous dam, a powerhouse containing two 7,700-hp turbines connected to two 6,250-kva generators, and appurtenant facilities.

The site is now owned by Eastern New York Power Corp, which has agreed to sell it to Black River Development Corp for $500,000. The latter will lease the plant on a 35-year net rental basis to Central New York Power Corp, which will assume all functions of operation, maintenance, generation, transmission, and distribution.

Floods in South Problem Now but a Benefit Later

Immediate problems and long-term benefits were the results of last weekend's sudden floods in Tennessee, Alabama, and Georgia.

Flood waters cost the interconnected power systems of the Tennessee Valley Authority and the Southern Co slightly more than 400,000 kw of capacity. But the filled reservoirs promise to ease power supply problems in the three-state region for months to come.

The floods followed a month of unprecedented rainfall, spokesmen for each system agreed. Striking last weekend (Nov 27-28), the floods raised tailwater at TVA's main river dams enough to lose 250,000 kw of capacity. This forced TVA to suspend peak-hour deliveries to interconnected utility systems. But while this was happening, TVA reported, its tributary river reservoirs were rising 10 to 20 ft. This added storage, at a time when TVA customarily is drawing its reservoirs down, will reduce the curtailments in delivery of secondary power which TVA had expected to have to impose on its aluminum and other industrial users later this winter.

Capacity loss due to the flood on the Southern System was limited to 160,000 kw, and its effects were expected to be ended this week unless more rain came. During the flood curtailment, Georgia Power Co lost a generator at Plant Atkinson, and the cumulative effects of these encroachments on capacity forced the utility to ask all customers to curtail temporarily. Storage reservoirs on the Southern System filled completely, and good conditions at the run-of-river plants are expected to continue.

As a result of the additional storage, one power supply expert told ELECTRICAL WORLD, TVA no longer need worry about a dry spring next year—at the time it ordinarily is filling its reservoirs. Likewise on the Southern System, where some storage space is available that can't be filled in a dry year, there no longer seems to be any danger that reservoirs will not fill next spring. This good fortune is regarded as especially strategic in the Southeast, where the power demand and supply margin are expected to be very close throughout next year.

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Municipal Plant Okayed

A $3,000,000 bond issue for construction of a municipally owned power plant and distribution system has been approved by voters of Henderson, Ky. Last year a bond issue was rejected.

CAA Ready to Adopt New 'Slope Line' Airport Lights

Civil Aeronautics Administration appeared set this week to adopt a new type of high-intensity lighting for airport approaches. The new lighting system, which is expected to get official sanction soon for both civilian and military airports, is a radical departure from the system produced experimentally by several major lighting manufacturers.

Called "Slope Line Lighting," it consists of a double row of lighting units fanning out from the end of a runway to a distance of 3,000 ft. Each unit contains ten 250-w, sealed-beam aircraft landing lights mounted in a 15-ft frame. The units are spaced 100 ft apart, 30 of them in each line extending from the end of the runway.

Two experimental slope line systems were manufactured for CAA by the Ermarco Corp, Dayton. Ermarco built and wired the units. CAA installed the lights. Those in the two existing systems were manufactured by the General Electric Co.

Two policy-making subcommittees of the Munitions Board must pass on the new system. But it already has the approval of the Airport Lighting Evaluation Panel, an organization of civilian and government agencies concerned with airport safety. The Munitions Board groups are expected to go along with the ALEP findings.

Such a decision will give CAA a green light for its plans to install approach lighting as a supplement to its instrument landing systems at the 163 major civilian airports. It also would permit the Air Force and Navy to order slope line lights for their domestic and foreign fields.

Estimated cost of a single slope line system is about $50,000, including installation costs. The lights would be placed at the end of only one runway at an airport—the instrument landing strip. CAA proposes to install lighting controls in airport control towers. The tower operator would modify the intensity of the lights in good visibility only.

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Transfer St. John System

Transfer of the New Brunswick Power Co distribution system to the City of St. John, N. B., has been completed. The exact purchase price has not yet been decided, but the approximate amount, $1,500,000, was borrowed until a bond issue for that amount should be ready.

$49,556,000 says we're right!

OUR load forecaster swears he'll eat his slide rule if in a few years you folks aren't using far greater amounts of gas and electricity than you are right now. We're so sure he's right that we'll spend $49,556,000 by the end of 1951 for the new or improved facilities we'll need to provide you adequate service then.

Actually we're just continuing a program we started right after V-J Day to catch up with time lost during the war years of shortages and building restrictions. We've accomplished a lot, but we must keep going.

Here are some of the jobs we'll do with that $49,556,000:

$24,596,000

Additions and improvements to electric generating facilities, including the installation of three new electric generators which will provide 133,800 kilowatts of added capacity by 1951.

$4,512,000

Increase capacity of 179 miles of existing transmission line circuits and add 74 miles of new high voltage transmission line circuits to carry power from the new generators.

$3,023,000

Increase capacity of existing electric substation facilities and add 30 new electric substations to distribute additional power.

$12,602,000

Increase capacity of existing electric distribution facilities and lines and add 500 miles of new distribution lines to carry greater amounts of electric power to Connecticut homes, factories, stores, farms and schools.

$1,937,000

Additions and improvements to gas-producing facilities, including installation of a new gas-making unit which will provide more capacity to help meet increasing demands.

$1,659,000

Install eight new gas holders which will provide storage for 9,000,000 cubic feet of gas.

$1,827,000

Additions and improvements to gas transmission and distribution facilities, including the installation of 52 miles of new gas mains to carry increased amounts of gas to our customers.

TOTAL—$49,556,000

That's a lot of money, but it isn't too much for the job to be done. Your demands for service are rising constantly and will continue to increase. We MUST spend $49,556,000 to meet them and prepare for future requirements.

THE CONNECTICUT LIGHT AND POWER COMPANY

A Business-Managed, Tax-Paying Company

ONE FORECASTER who better be right is the load forecaster of Connecticut Light & Power Co. Using his estimates of future demands, the utility has planned to spend $49,556,000 for expanding its electric and gas plant by the end of 1951. The advertisement is one of a series being run in newspapers to explain the expansion program to the public

Reclamation to Ask Bids on 3 Transmission Lines

The Bureau of Reclamation plans to ask for bids on three transmission line projects during December. The bid calls, tentatively announced this week, will be issued by the Denver engineering office and regional offices.

First transmission line bids will cover three loops on the Yakima project, Washington. They will include 63 miles of 34.5-kv three-phase lines; 2.6 miles of 13.8-kv three-phase, and 2.6 miles of 2.4-kv single-phase. The Bureau will furnish most of the line hardware.

Another call is scheduled for Dec 28 on the 115-kv loop between substations on the Davis Dam project, near Eloy, Ariz. This is a single circuit three-phase loop. Bids will be sought Dec 30 for construction of the 52-mile, 115-kv line from Goshen to Palisades, Idaho, on the Palisades project.

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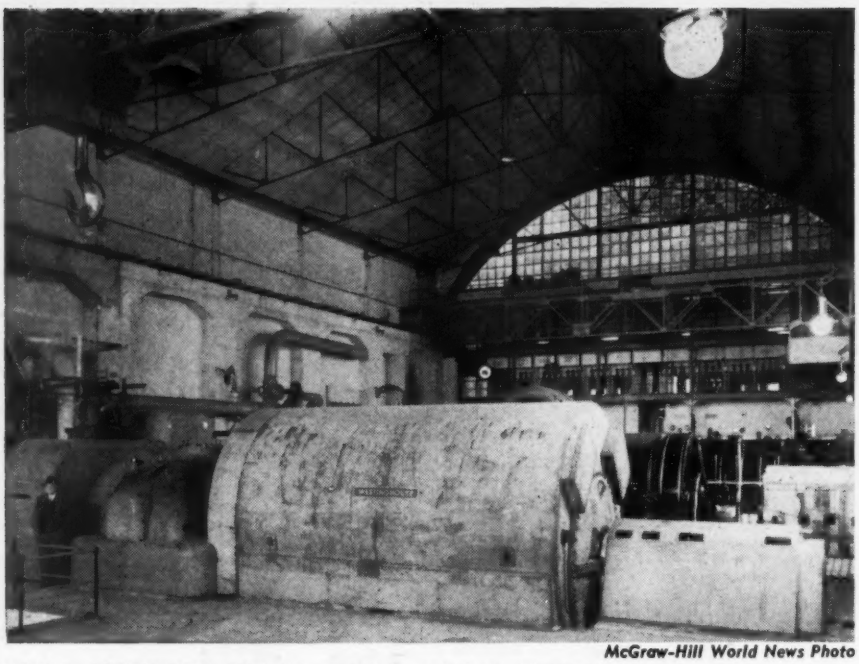
TVA to Move Division

The Tennessee Valley Authority will move its property and supply division from Knoxville to Chattanooga late in 1949. The announcement was made early to give the 150 employees time to make the necessary arrangements.



McGraw-Hill World News Photo

USINA SORRIENTO PLANT of the Sociedad de Electricidad de Rosario at Rosario, Argentina's second largest city, where a 33,000-kw generator has been installed

Lyles-Ford Project Gets Tentative FPC Go-Ahead

Another multi-million-dollar hydroelectric public power project seems destined for South Carolina now that the Federal Power Commission has given it a temporary green light.

For some time the Lyles-Ford Tri-County Authority, state-created but non-operative, has been planning construction of three power projects on the Broad and Congaree Rivers. FPC now has given the go-ahead on cost survey, first step toward construction. It is estimated that the project would cost more than $60,000,000, a figure considered low in terms of present-day costs by some engineers.

Included are concrete-earth dams at Blairs and Frost Shoals on the Broad River and a concrete re-regulating dam at Columbia on the Congaree. The Blairs project would have 108,000-kw capacity, with a 60,000-kw steam standby plant. Frost Shoals dam would be 95 ft high, with 96,000-kw capacity, and the 63-ft Columbia structure would have a 39,000-kw hydro plant.

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Efforts to Stop Sale Fails

The state-owned South Carolina Public Service Authority, operator of the Santee-Cooper project, lost another round of its continued fight to block approval of the $10,200,000 sale of South Carolina Power Co to South Carolina Electric & Gas Co by Commonwealth & Southern Corp. The Fourth United States Circuit Court in Baltimore ruled that the authority could not be considered "as an aggrieved party" and furthermore had not made a case to justify disturbing the orders of the Federal Power Commission and the Securities and Exchange Commission approving the sale.

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Arkansas P&L Lease of Plant Gets Voters OK

Voters of Forrest City, Ark., have approved lease of the municipally owned generating plant and distribution system to the Arkansas Power & Light Co for 30 years, provided AP&L will put its new $15,000,000 generating station within a radius of seven miles from the city. The projected station will have an initial installed capacty of 125,000 kw, with design for an equal additional capacity later.

The election was marked by a week of strenuous campaigning. Proponents pointed out that the plant, within the city school district, would mean added tax revenues for the schools; that it would bring natural gas close to Forrest City; and that it would employ 60 additional persons. Opponents said that profits from the city's operation had paved streets and alleys.

AP&L promised in the lease offer it submitted to put into effect its standard rates, which would result in an estimated $10,000 annual saving to residential customers.

SEC RULINGS

NIAGARA HUDSON POWER CORP's request for a six-months extension from Nov 1, 1948 to May 1, 1949 of the time within which it must dispose of all of its interest, direct or indirect, in Buffalo Niagara Electric Corp and the subsidiaries thereof, has been granted. (Release No. 8623).

ENGINEERS PUBLIC SERVICE CO has been allowed to acquire rights issued by Virginia Electric & Power Co to subscribe to additional shares of its common stock. Engineers owns 162,612 shares (approximately 5.5%) of the common stock of Virginia Electric & Power Co. The latter company proposed to issue to the holders of record of its common stock on Nov 12, 1948, rights to subscribe to additional common stock on the basis of one additional share for each four shares then held. (Release No. 8631).

COMMONWEALTH & SOUTHERN CORP's dissolution plan has been approved. Dissolution and liquidation of the company is to be accomplished through the retirement of its outstanding preferred stock in exchange for certain portfolio securities and cash, and the distribution of the remaining assets to the common stockholders. Under the plan, the holders of Commonwealth's 1,441,247 shares of outstanding preferred stock will receive 2.80 shares of common stock of the Consumers Power Co; 0.55 of a share of common stock of Central Illinois Light Co and $1 in cash for each preferred share held. Simultaneously with the distribution to preferred stockholders, the holders of Commonwealth's 33,673,328 shares of outstanding common stock will receive an initial distribution of 0.35 of a share of common stock of the Southern Co, which is a subsidiary of Commonwealth. After these distributions Commonwealth will parcel out its common stock holdings of Southern Indiana Gas & Electric Co and of Ohio Edison Co to its common stockholders. These final distributions will be subject to Commonwealth's repayment of a temporary bank loan that may total $25,000,000. Holders of Commonwealth's option warrants will not be allowed to participate in the reorganization distributions. (Release No. 8633).

AMERICAN LIGHT & TRACTION CO has been authorized to sell at competitive bidding remaining stock interest of 192,734 common shares of Detroit Edison Co. (Release No. 8634).

MEETINGS

Interstate Power Club of New York—Meeting, Hotel Martinique, December 13. E. L. Huse, secretary, Jersey Central Power & Light Co, Morristown, N. J.

Canadian Electrical Association—Winter Conference, Chateau Frontenac, Quebec, January 17-19. B. C. Fairchild, managing director, Room 704 Tramways Building, Montreal 1, Canada.

American Institute of Electrical Engineers—Winter General Meeting, Statler Hotel, New York, January 31-February 4. H. H. Henline, secretary, 33 West 39th St, New York 18, N. Y.

California Oregon Power Will Spend $30,000,000

A $30,000,000 construction program outlined by the California Oregon Power Co includes completion of the Toketee Falls hydroelectric plant on the North Umpqua River in western Oregon and construction of two additional power plants in the same area. Also included in the company's program for the next five years are additions to transmission and distribution systems.

The Toketee Falls project, which is scheduled to start delivery of 27,000 kw of power in 1949, is designed for a maximum capacity of 40,500 kw by 1950. The two additional hydro plants, for which studies are now being made, will provide 65,000 kw additional. With their completion, planned for 1953, the company will have a hydro capacity of approximately 207,000 kw.

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Canadian Output Statistics

The Dominion Bureau of Statistics has announced the following statistics of Canadian production and consumption of electrical energy. Figures are in thousands of kilowatt hours:

Period	1948	1947
Nine months	33,512,906	33,780,211
Primary	31,311,439	28,520,421
Secondary	2,201,467	5,259,790
Primary Consumption	30,313,587	28,272,277
Exports to U. S.	1,277,903	1,636,453
September	3,604,218	3,589,497
Primary	3,478,160	3,188,810
Secondary	126,058	400,687
Primary Consumption	3,369,146	3,073,808
Exports to U. S.	123,652	152,864
August	3,699,472	3,641,476
Primary	3,528,465	3,168,385
Secondary	171,007	473,091
Primary Consumption	3,414,109	3,060,134
Exports to U. S.	138,134	195,889

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Potlatch System Sold

Potlatch Forests, Inc's distribution system in Potlatch, Idaho, has been purchased by the Washington Water Power Co. Extensive rebuilding of the system is planned, most of it scheduled for early 1949. WWP has been supplying the bulk of the power for the Potlatch milling operation since 1946.

Other News

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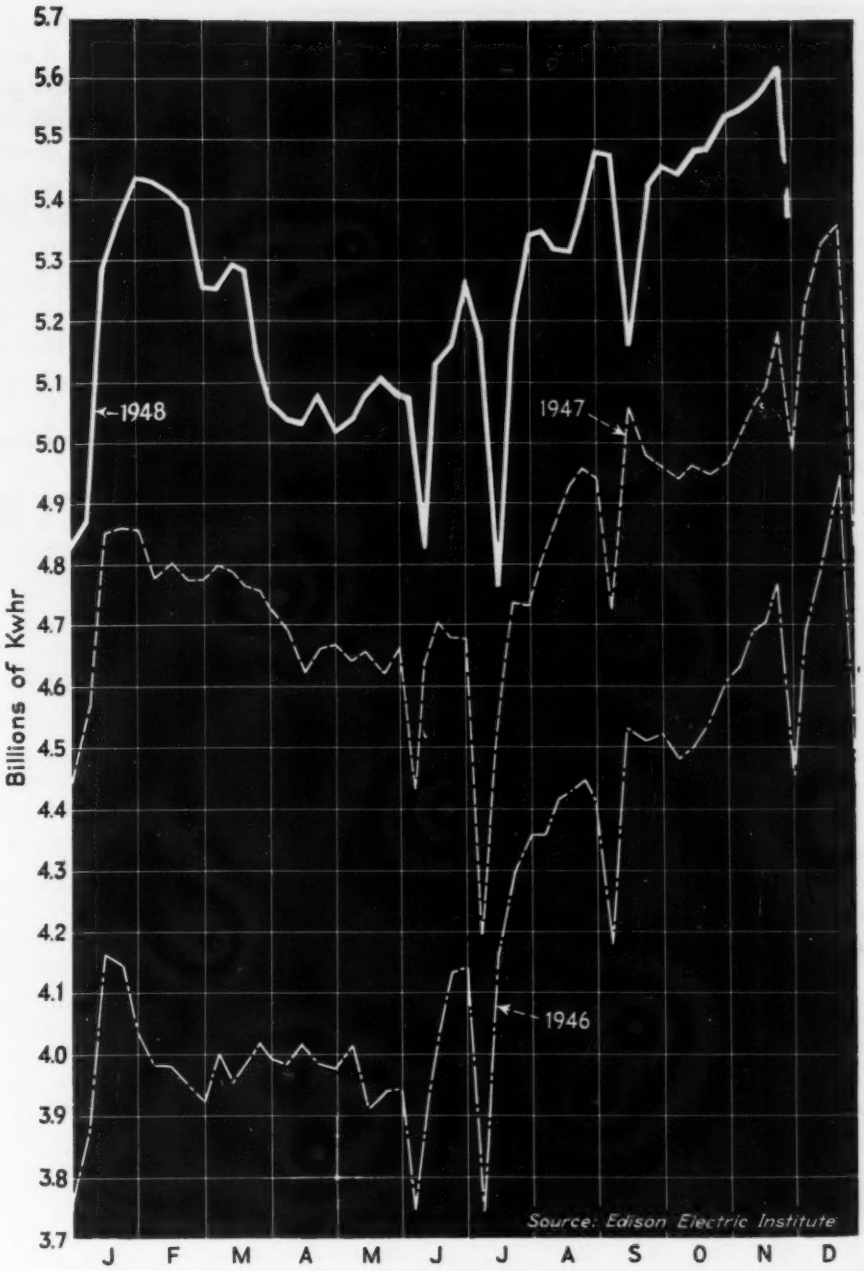


Slowing Energy Demand to Aid in December

Output for Thanksgiving Week, which ended Nov. 27, was 5,373,597,000 kwhr, only 7.8% above last year. This was the first week in eight in which no output record was set, but it was the fifth successive week in which the increase over last year declined.

Since Thanksgiving provides the utilities with a breather before the pressing demands of December, this is a good time to study the prospects for the coming month.

All present indications are that output for December's peak week will be less than 5.8 billion kwhr. Curtailment of power to industries in certain areas is helping keep the total output down. Daylight Saving Time in California and Nevada is another contributing factor. Power capacity for the December peak will be at least 6% over last year.

Weekly Output, Millions Kwhr

1948	1947	1946
Nov 27 5,374	Nov 29 4,983	Nov 30 4,448
Nov 20 5,627	Nov 22 5,180	Nov 23 4,765
Nov 13 5,571	Nov 15 5,084	Nov 16 4,700
Nov 6 5,564	Nov 8 5,057	Nov 9 4,682
Oct 30 5,555	Nov 1 5,009	Nov 2 4,628
Oct 23 5,539	Oct 25 4,964	Oct 26 4,602
Oct 16 5,482	Oct 18 4,946	Oct 19 4,540
Oct 9 5,482	Oct 11 4,958	Oct 12 4,495
Oct 2 5,449	Oct 4 4,935	Oct 5 4,478

Percent Change from Previous Year

	Nov 27	Nov 20	Nov 13
New England	+ 3.1	+ 3.8	+ 3.8
Mid-Atlantic	+ 3.6	+ 4.1	+ 5.0
Central Industrial	+ 6.7	+ 8.0	+ 8.3
West Central	+ 7.8	+ 8.2	+11.7
Southern States	+11.1	+10.7	+11.1
Rocky Mountain	+17.3	+21.1	+20.9
Pacific Coast	+ 9.4	+10.9	+13.6
Total United States	+ 7.8	+ 8.6	+ 9.6

WASHINGTON COMMENT

WILLIAM B. WHICHARD

IT'S A YEAR of surprises. If the election failed to prove that, a recent decision of the U. S. Supreme Court was the clincher.

The high court, which in the past has countenanced some rather broad stretching of the Federal Power Act, ruled it out of the Grand River Dam case. How the Act got into the proceeding, a dispute over value of the dam site, probably is best known to attorneys for certain federal agencies. For once, at least, a majority of the Supreme Court refused to go along with views of such legal talent on the scope of the Power Act.

Grand River Dam Authority's legal wrangle with the Grand Hydro Corp had been in the courts since 1939. The Tulsa firm, which previously had purchased lands now occupied by Grand River Dam, deeded them over to GRDA after the agency was established by Oklahoma.

Grand Hydro held it should be compensated for the land on the basis of its value for hydroelectric development. GRDA contended that the legislature had given it exclusive development rights, thus the land had no such value to the company. The state agency insisted that $136,250, the estimated value of the site for farming or similar uses, was a fair price. Under protest it paid $281,802 as ordered by a county court.

Then the Oklahoma Supreme Court upheld Grand Hydro's claim to dam-site value. Result was award of a judgment against GRDA for a total of $800,000. The agency thus was faced with payment of the remaining $518,197, plus interest accruing since 1940, when it paid the company the amount fixed by a lower court.

GRDA carried an appeal to the Supreme Court on the advice of counsel. Among those advising the agency were representatives of the Federal Works Agency. FWA, as the holder of $13,900,000 of GRDA bonds, had very obvious interest in the matter. Federal Power Commission, which probably became involved at FWA's request, was treading on less solid legal ground.

FPC attorneys said their interest stemmed from the fact that Grand River Dam had been licensed under the Federal Power Act. At the end of the license period FPC would be required to establish net investment in the project. The Commission, its attorneys continued, might find it impossible under FPC accounting principles to allow $800,000 as legitimate cost of the land.

Reference also was made to previous court refusals to acknowledge water rights claimed by private citizens in navigable streams. But, as the Supreme Court noted, Grand Hydro had claimed no such vested rights. And the court was even more summary in dealing with the crux of the FPC argument.

The $800,000 land price had been arrived at by proceedings under Oklahoma's condenmation laws, the court majority asserted. There is "nothing in the Federal Power Act," it added, to indicate that the Act had been designed by Congress to require any "nationwide change" in state condemnation laws.

The court conceded that condemnation of land by the U. S. or a licensee under procedures provided by the Act might present "different considerations." In addition, the Act does not require the "seller, rather than the purchaser," of a hydro site to absorb any reduction in allowance of value for land which might be required later by FPC in setting a rate base or net investment.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Fault location on 110 kv by radar-type pulse reflection timing has been done to within 0.6% of true distance, readily within 2.5%.

Machine-casting of steel promises to "short-circuit" such otherwise necessary operations as ingots, soaking pits and blooming mills.

Antennas on passenger cars, if mounted fairly low at the left rear, sacrifice little in directional reception but do offer reduced breakage from low bridges and entrances or from contact with garage roof during an elevated greasing job.

Hydro power should be obtainable from desert depressions near enough to a sea or river. Egypt plans to take Mediterranean water 45 miles to the Qattara 400-ft-deep dry lake, expecting the sun's heat will evaporate the water from the resulting 8,000 square mile pond after 300,000 kw have been extracted.

Water heaters are now being insulated in the United Kingdom with granulated peat in lieu of cork.

Phase modulation produces wide-swing FM signals with 80-db noise reduction and minimized harmonic distortion; the system promises to supersede the prevailing dual-channel method of handling FM.

Pressure-vessel codes are local obstacles to more extensive adoption of higher operating pressures for hydrogen for generator cooling. Just why is a generator shell a pressure vessel at 25-30 psi?

Natural frequency of a system's recovery voltage can be found oscillographically by open-circuiting a choke coil that has had shunted to it enough load current to represent 10% of full short-circuit current.

Switched Capacitors Control Voltage And Improve System Loading

Pennsylvania utility will install 90,000 kvar of switched capacitors on 4-kv and 12-kv system to relieve loading on generators, lines and transformers and provide supplementary voltage control

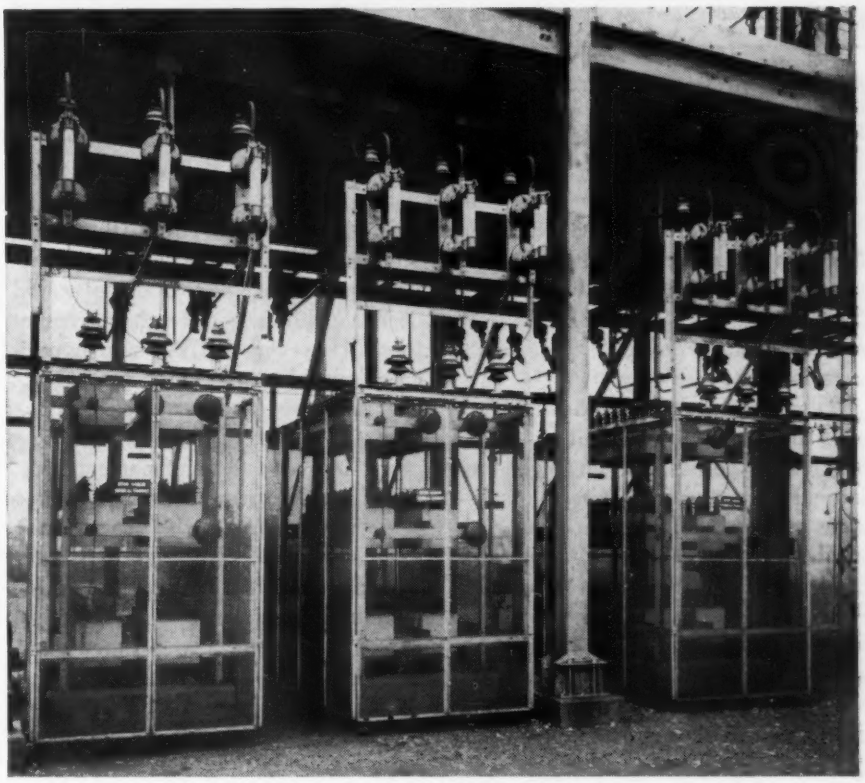
NICHOLAS N. SMELOFF
and
OLIVER RAMSAUR
System Planning Dept
Pennsylvania Power & Light Co
Allentown

A PROGRAM of installing capacity to take care of load growth is now in progress on the system of the Pennsylvania Power & Light Co. To supply the power component the installation of a new 150,000-kw generating station is well under way near Sunbury, Pa. And to supply the reactive component some 90,000 kvar of switched capacitors are being added to the system.

This article will outline some of the thinking behind the addition of this amount of switched capacitors. A later article will describe some of the installations.

In brief, the application of switched capacitors on the PP&L system is, for the most part, an extension of the principle of applying synchronous condensers for voltage control and load reduction through power factor improvement. Advantage is taken of the fact that capacitors are lower in both initial and operation cost and upkeep; and that they are now low enough in cost to be dispersed in smaller sizes nearer to the actual load and controlled automatically. Thus they not only release generation, transmission, distribution, and transformer capacity to carry additional load but also provide adequate voltage control in the manner this company practices.

Because of the wide dispersion of this system and the variety of loads served—all the way from residential service to large industrial users requiring thousands of kilowatts—it is necessary that the voltage on all lines, from the 66-kv "backbone" down through 12-kv and 4-kv distribution and low-voltage secondaries, be suitable for direct supply to loads of appropriate size.



CAPACITOR RACKS comprising half of a 6,000-kva bank connected to the 12-kv inspection bus at a 40,000-kva, 66-12 kv step-down substation feeding large distribution system. The bank is manually switched with bus tie breaker; each rack has its own fuse protection

The method of controlling voltage used by this company is in some respects unique. Very few feeder voltage regulators are used. Instead, the voltage level of the entire supply system is raised or lowered to compensate for increases or decreases in voltage drop due to load. This is done at all power generating stations and at large load centers throughout the system where synchonous condensers or switched capacitors are available. In addition, switched capacitors, located at the smaller load centers and out along distribution feeders, uphold the voltage at points where it would otherwise sag. By this means of control, adequate voltage is delivered to all but a very few fringe points, where appropriate supplementary measures are taken.

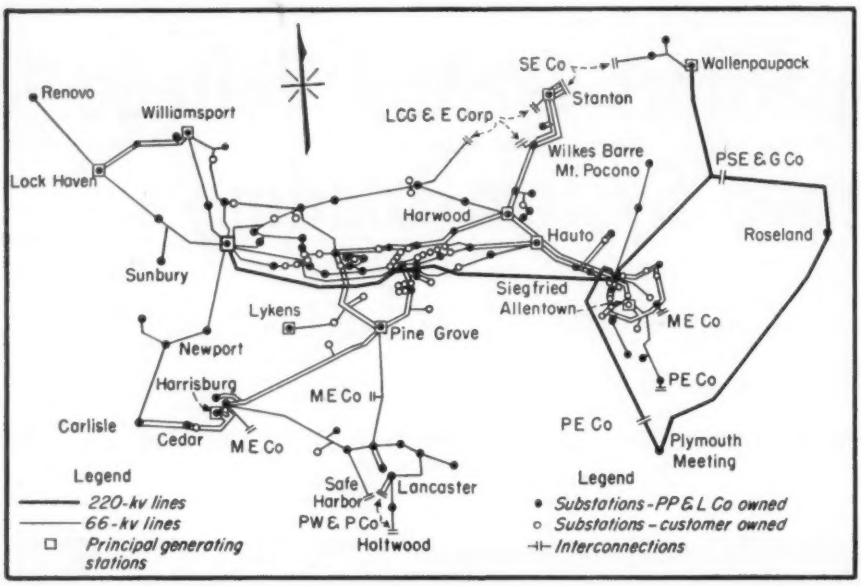


FIG 1—TRANSMISSION SYSTEM of Pennsylvania Power & Light Co consists of 220 and 66-kv networks. Entire 66-kv system is treated as a sort of bus. Its voltage is raised and lowered to fit the load by using generators, synchronous condensers and switched capacitors

This method of control is described fully in a recent AIEE technical paper (No. 48-264), entitled *Power System Voltage Control Without Feeder Voltage Regulators*, which says in part:

"The power system [shown] consists of a 66-kv *network* of lines, fed at strategic points from large generating stations and a 220-kv transmission system. While there is some local distribution from generator buses, the bulk of the power is delivered directly to the 66-kv system from which transformations are made for supply directly to large power customers, as well as to the standard distribution voltages of 12 or 4 kv.

"The significant feature of the system, from the voltage control standpoint, is that customers are served from any of the standard voltages except the 220 kv. The practice results in an unusually large number of substations.

"On the company's 66-kv system . . . customers are too numerous for each to be supplied economically with a separate regulator. Instead, the idea of bus regulation is extended and the entire 66-kv system treated as a sort of bus whose voltage is raised and lowered to fit the load by using the reactive capacity of generators and of synchronous condensers installed at the load centers and load ratio control at the points of stepdown from 220 kv."

It might appear that the large amount of switchable reactive capacity required for voltage control would cost more than feeder voltage regulators. However, analysis and experience have shown:

1. That reactive generation *at the load* is necessary to avoid adding more lines and transformer capacity.

2. That this reactive supply must largely be *variable* with the load, so that a fairly high over-all power factor can be maintained "on peak" without having the system swamped with an excess of uncontrolled reactive generation "off peak".

3. That judicious application of this variable reactive capacity, supplementing the raising and lowering of the voltage level of the main supply system, does result in adequate voltages being supplied throughout practically all of the distribution system. Thus it can be said that the voltage control itself is a by-product of local reactive generation.

Very few additional unswitched capacitors are planned, for the reason given above and because power customers are installing considerable amounts under the incentive of the power factor clause in rates.

Synchronous condensers have long been used at load centers to provide the necessary variable supply of reactive kva. But it is now well known that switched capacitors are cheaper due to lower first cost and losses.

This lower cost makes it feasible to disperse reactive capacity in fairly small units closer to the load itself, thus obtaining additional benefits in both load relief and voltage control.

Other advantages of switched capacitors are: Less loss of capacity and quicker repairs after equipment failures; ability to increase sizes readily; simplicity of automatic control; flexibility; and quicker delivery and installation.

Capacitor Requirements

Anticipation of capacitor requirements was based on the needs for:

1. Large blocks of capacitors to supply reactive kva to a given region. where relief of loading on power generators and transmission facilties was the prime object.

2. Smaller units to provide additional voltage control at points where this was the prime object.

3. Replacement of reactive generation now obtained from certain older and smaller high-cost generating stations that are scheduled for shutdown when large low-cost generating units are installed elsewhere.

An over-all check, on the total reactive capacity to be added and the relative portions of capacitors to be automatically switched, was made using the results of system power factor surveys conducted periodically for the past 18 years. How the kilovar load has increased in relation to the kilowatt load is shown in Fig 2.

The additon of capacitors to the system for any one of the above purposes also accomplishes the objectives of voltage control and relief of system loading. The paramount need for kilovars at a particular place determines the amount, and how it is to be applied.

Effect of Adding Kilovars

Every kilovar added to a given region has its effect throughout the entire region. That is, each kilovar added in a small unit out along a distribution feeder has the same effect on voltage at the load center as one added at the load center; and it has a still greater effect on the voltage at the point of application. Because general distribution is at both 12 kv and 4 kv, capacitors are required in various sizes for both voltages.

Two factors which govern the sizes of banks of switched capacitors are:

1. The cost of the switching equipment. This increases the cost per kilovar as the size of the capacitor bank is reduced. The switching of small banks is uneconomical where the cost of the switch is a consideable part of total cost.

2. The maximum permissible sudden change in voltage when a capacitor bank is switched on or off. This prohibits the switching of large banks on the ends of distribution feeders. It is the practice of this company to limit the change of voltage to 3% for most applications, with an upper limit of 5% for certain outlying areas where changes are expected only in early morning and late evening. The 3% normal limit has resulted in no complaints. Further experience may indicate that it can be increased. The 5% limit has not yet been seasoned by experience.

4-Kv Applications

Package-type 180-kva, automatically-switched, metal-clad, pole-top units have been used for most of the 4-kv applications. This unit fits well into the size limitations. As a result of the availability of a low-cost switch, it is both economical and small enough to use as far out as three to four miles on 4-kv feeders, without exceeding the 3% limit on sudden voltage change. Many of these are now in service, with good results. In a few cases several units have been installed at one location where comparatively large amounts of reactive kva were required. They were available for quick application and solved the problem with a minimum of rearrangement and reconstruction of existing facilities.

The use of open-type units is now being considered where the capacitors and the switching and protective equipment are to be mounted on cross arms. This avoids the need for platforms, thus improving appearance as well as reducing over-all cost.

Prior to adoption of the 180-kva units, several installations were made, each designed for the particular application. It may be of interest to note that this company pioneered the installation of automatically-switched capacitors 12 years ago with the purchase of two 3-step automatic units; one an indoor unit of 540 kva and the other an outdoor unit of 990 kva. Both have seen continuous and satisfactory service on the buses of 12-4 kv step-down substations. Several field-assembled units of a similar nature have also been installed.

In addition, several mobile multi-step units of up to 1,080 kva each have been used almost continuously during substation outage.

12-Kv Applications

For application on 12-kv systems, the installations have been more varied to suit a wider range of conditions. These applications can be grouped into two general classes:

1. Manually-switched single-step capacitors on large load center buses. These are used primarily for bulk supply of reactive kva, to relieve generation and transmission facilities. Switching is done with existing inspection bus-tie oil circuit breakers. The capacitors are arranged in groups of not more than 1,080 kva, with a single set of fuses.

2. Automatically-switched capacitors primarily for voltage control on buses at distribution load centers and some smaller unattended 66-12-kv step-down substations. Those installed so far have been field-assembled. They consist of outdoor-type units with suitable switching equipment. Delivery has started on 17 factory-assembled units of 2,700 kva, each with three steps of 900 kva. These are being applied both at the buses of 66-12-kv step-down substations and out on 12-kv feeders where the voltage change limitation will not be exceeded. In some cases, only the first one or two steps are being installed initially. Other steps are to be added as growth requires.

Equipment Unavailable

There has been a demand for small-size 12-kv automatic capacitors on this system. However, widespread application has been retarded by the unavailability of low-cost switching equipment. The low-cost oil switch used in the 4-kv package-type units has made them economical for general application in small sizes. However, up to now, power circuit breakers have been used for switching 12-kv capacitors. But the cost of such breakers is too high for economical switching of small banks.

General practice has been to use power circuit breakers to perform two functions: (a) switching and

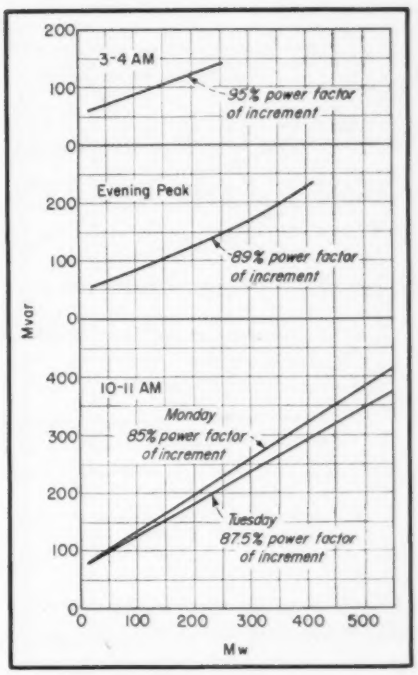


FIG 2—RELATIONSHIP between kilowatt and kilovar load during daytime, evening peak and early morning hours

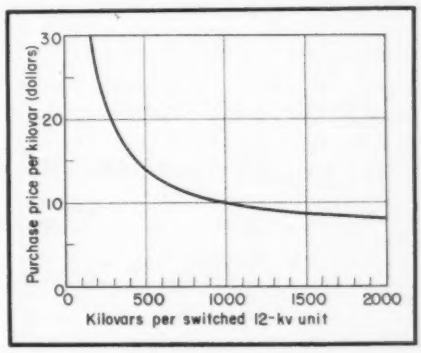
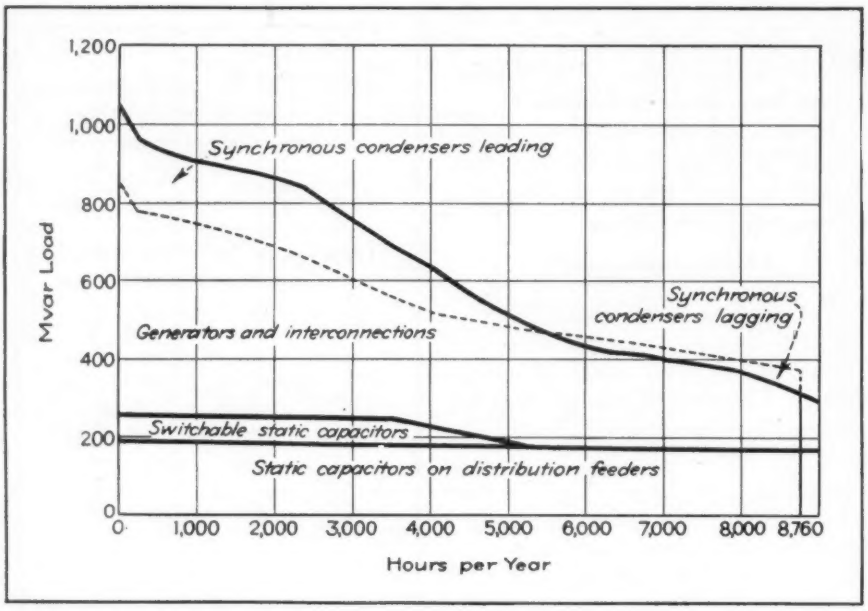


FIG 3—COST PER KILOVAR of 12-kv switched capacitor unit varies with size. Below 800 kvar cost rises rapidly due to cost of switching component

(b) fault clearing. On the basis that the cost could be reduced if these two functions were divorced, this company has provided back-up fuses for fault clearing, leaving only the switching function to the switch. For this purpose, both low-capacity oil circuit breakers and 3-pole circuit reclosers have been used successfully.

To meet the demand for low-cost 12-kv capacitor switching, manufacturers were asked two years ago if they could supply a switch suitable for switching purposes only. As a result, a simple oil switch has been developed that has no short-circuit interrupting rating. Back-up fuses are provided for that purpose. This development has paved the way

(*Continued on page* 161)



DURATION CURVE for megavar supply to system in 1947

Criteria of Kilovar Supply

Outline of four main sources of kilovar supply . . . Proportions of supply requirements for the system . . . Eliminate term "power factor" . . . Utilize kilovolt-ampere demand charges

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IN ADDITION to kilowatts being furnished for utilization equipment, reactive kilovolt-amperes or kilovars must be made available to users of electric service in order to excite or magnetize their electric equipment. These kilovars can be furnished by either the customer or the electric utility company. Since a utility is primarily in the business of providing the customer with all his electric service, this presentation will be from the viewpoint of the utility supplying all of the kvar capacity. Methods used by electric utilities to do this will be described.

When a customer takes either active power or reactive power from the utility's lines, the cost in both capital investment and operating expenses on any basis of allocating costs between kilowatts and kilovars is much less for kvar supply than for kw supply. But the importance of kilovars is no less than that of kilowatts since the excitation or magnetization of the system is essential to the delivery of power to the customer.

As is the case in the customer's system, carrying loads through the utility's lines and transformers requires magnetic fields around the conductors proportional to the current carried. That condition introduces a "consumption" of kilovars in series with the load similar to that of kw losses which are also in series with the load. Also, to furnish the exciting currents for all of the transformers in the system or induction motors on station auxiliaries, shunt reactive power is required from the system. The reactive power required for these purposes is largely required because of the customer's kw load and hence is considered a charge against supplying kilowatts, but customers also demanding considerable reactive power will proportionally increase this requirement for magnetizing reactive power.

Sources Considered

Engineering studies made for the Public Service Electric and Gas Co took into consideration the limitations imposed by generator stability, the relative net cost of various means of providing kvar capacity, and the minimum kvar load requirements which limit the amount of unswitched static capacitors that may be connected to the system. In these studies the several sources of kvar supply considered were: Permanently connected capacitors at the load, on the feeders, at the substation or on the generator bus; switchable capacitors which can be added or disconnected to the line depending on the continuously observed reactive load; generators from which kilovars can be supplied to other parts of the system; and synchronous condensers located at substations, switching stations or generating stations.

Costs of Supply

Four main sources of kvar supply arranged according to their relative incremental costs, and with their advantages and limitations, are listed elsewhere in this article. This relative net cost has been determined by evaluating the cost of the equivalent kvar capacity required, the added system investment component effected by kvar loading, and the incremental changes in losses in the system and corrective equipment. Taking the kvar supply in generators as 100%, the relative cost of kvar supply in non-switched static capacitors is 60%, and 85% in switched capacitors. Likewise, the cost in synchronous condensers may be as high as 140%, depending upon their size. It should be noted that these costs are representative of a particular study and are not necessarily generally applicable.

An adaptation of a discussion at a joint meeting of the New Jersey Section and Power and Industrial Divisions of AIEE at Newark, N. Y.

In the period prior to World War I, both kilowatts and kilovars were supplied in the Public Service Electric and Gas Co system by the generators as the load was largely made up of residential and street railway loads supplied by rotaries and motor-generator sets. During World War I, and continuing thereafter, industrial loads became an increasing proportion of the total. To meet the increasing kvar demand of these loads, synchronous condensers were installed in switching stations and substations. During the depression, the costs of static capacitors were greatly reduced, and in the recovery period that followed many of these were installed in preference to synchronous condensers. The latter could only be proven in in those cases where building space was available and more flexible control of capacity and voltage was desirable.

Four Principal Sources of Kilovar Supply

1. Static capacitors installed on distribution circuits are the most economical because of their lower first cost, proximity to the load and saving in system investment and losses.

2. Switchable capacitors installed on distribution circuits or substation buses are the next most desirable method.

3. Generators with larger stator and field windings are the next least expensive because of the unavoidable overbuild that always is present in a transmission and distribution system having adequate spare capacity, even though some added system investment or losses may be incurred.

4. Synchronous condensers represent the most expensive method of all due to their higher initial cost and greater losses, although in specific instances they may be proven in by their continuous regulating performance, inherent voltage stabilizing influence and ability to operate as a lagging load permitting the installation of larger amounts of unswitched capacitors.

Percentages Furnished

Based on the latest studies, the present kvar requirements on the Public Service Electric and Gas Co system are supplied in the following proportions: 57% in generators; 18% in synchronous condensers; and 25% in static capacitors of which about 27% are switched. This is shown in the accompanying graph by the annual megavar load duration curve for 1947. The individual ordinates on the curve indicate the value of megavar load for any hour of the year, the individual segments of these ordinates showing the source of supply.

Explanation of Graph

In general, the maximum ordinates to the extreme left represent the early evening hours in winter, and as the ordinates level off, the day hours. The minimum ordinates to the right represent the night hours and the last ordinate on the extreme right is the minimum megavar load. Usually there are, in the early morning of certain days, a few hours of extremely low megavar load which is lower than can be indicated on the curve. The shunt capacity in cables and lines largely offsets the XI^2 losses in the system.

Other conclusions reached in these studies are:

1. Reactive capacity in one form or another, particularly capacitors, can quickly make available additional kw capacity and by proper location postpone the installation of additional transmission and distribution facilities.

2. Extensive application of kvar supply close to the load is not likely to permit standardizing on 90% power factor generators with low short circuit ratio. This is particularly true considering the entire life of the machine where older machines become relatively less efficient and their capacity may be used to supply kilovars resulting in low power-factor operations.

3. Uniform policies throughout the industry would be desirable to promote the use of lower kilovar "consuming" equipment but must curtail its improper use by customers.

4. Except for engineering discussions such as this one, the term "power factor" should be eliminated. Rate clauses should be formulated without specific mention of power factor and without the consequent necessity of educating customers as to its meaning.

5. Rate clauses should be simple. Out of about 600 power factor adjustment clauses selected for analysis, one in five had a different basis for adjusting power factor, although the predominant method adjusted the kw demand by the ratio of basic to actual power factor.

Kva Demand Charges

6. Only 2-part demand rates involving kw demand and excess kvar or kva demand charges can closely compensate for actual system cost. Kva demand charges do this more accurately than do kvar demand charges.

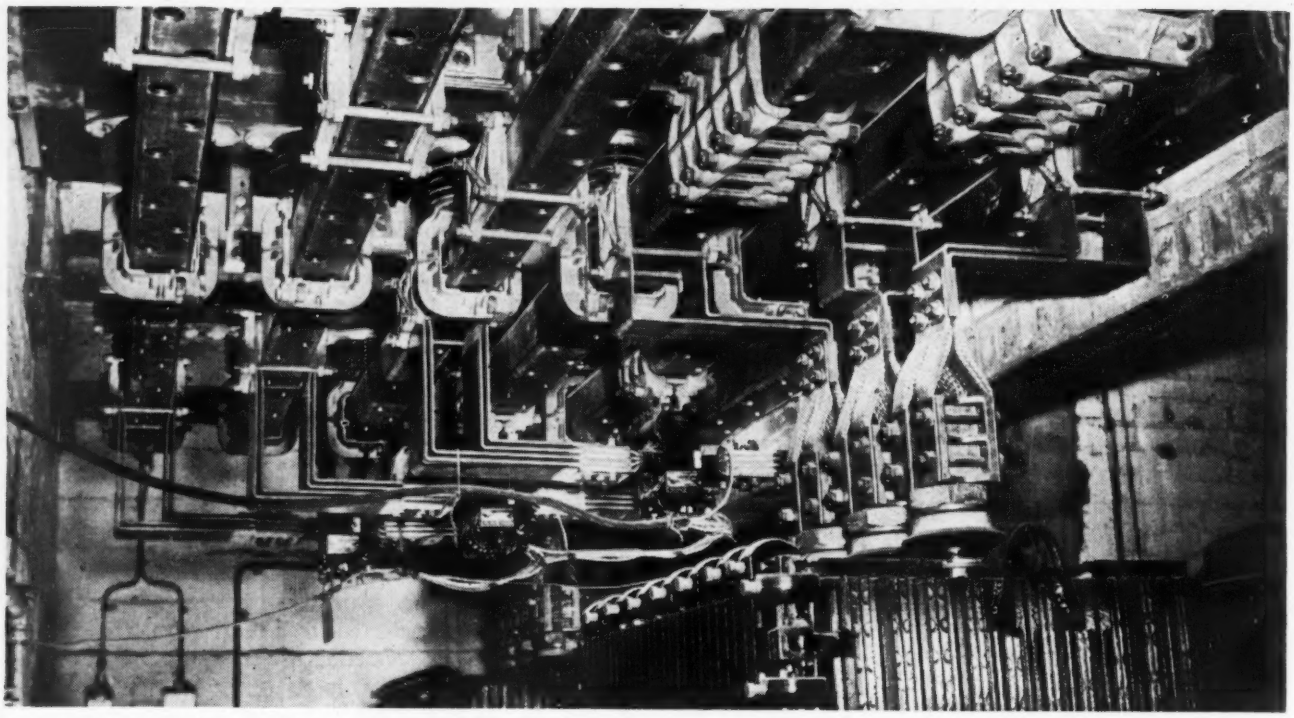
7. Excess kva demand charges are to be preferred as they can be readily explained, simply metered, and give decreasing credit per kvar capacity installed by the customer. Therefore, he is given greater encouragement to install corrective equipment with relatively higher kvar loads than kw loads.

8. In order that the excess kva demand charge shall be no more than self-sustaining, it is important that it correspond to the cost of providing corrective equipment. The best overall economy will probably result if the utilties supply this equipment and economically schedule it with other generation, transmission, substation and distribution facilities. Therefore, the charge would generally not induce the customers to install corrective equipment unless other collateral advantages are realized.

Exemption Desirable

9. When the additional charge affects any customer's bill by only a small percentage, this constitutes no valid objection to the adoption of the principle of the charge, except possibly making it desirable to exempt the small customers who fall in the first kw block. In general, these customers are not important low power-factor offenders.

10. The utility's commercial department has an opportunity to demonstrate economies to customers through the proper application of utilization equipment. Customers themselves will recognize the value of improving the efficiency of motor applications and using synchronous motors whenever practicable.



VENTILATED HOLLOW SQUARE COPPER TUBES form 5-in. main bus and 4-in. metered bus for 8,000 amp feeder in bank building

Large Capacity Service Bus Design

Consideration is given to factors affecting ultimate bus capacity and conductor arrangement . . . Examples of construction and design illustrate economy of providing for increased loads

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SERVICE BUSES for secondary network systems, such as shown in picture on this page, are presently attaining such high capacity rating that all factors affecting that capacity must be considered in the design. These factors include: (1) Proximity effect; (2) skin effect; (3) inductive heating; and (4) conductor arrangements.

These factors are particularly worthy of consideration in buses exceeding 3,000 amp in capacity. With the increased lighting level, the trend toward the mechanization of office work, and the complete air conditioning of large office buildings and commercial establishments, many services are reaching that capacity. Where the ultimate bus capacity is not expected to exceed the 3,000 amp, the design may be for either bar or cable bus, whichever better suits local condition. But where the ultimate bus capacity is expected to exceed 3,000 amp, these factors should be considered.

PROXIMITY EFFECT.—This phenomenon, which when two phases are adjacent to each other tends to force the current in each phase conductor to the side nearest the other phase, has its greatest effect in single phase operation where the two currents are 180 deg out of phase. It is less for 3-phase operations since the current is displaced 120 deg. In general, the effect is inversely proportional to the distance between phase conductors. It definitely affects the current carrying capacity of large buses when the phase spacing is less than 18 in. An empirical rule which seems reasonable for good design is as follows: For 10-in. phase spacing of buses between 3,000 and 4,000 amp, the conductor's rated capacity should be reduced 8%; and for buses above 4,000 amp at 10-in. spacing, 15%. Below 3,000 amp or above 18-in. phase separation, proximity effect may be ignored. For phase spacing between 10 and 18 in. interpolate for the percentage reducing factor.

SKIN EFFECT.—Since in all a-c conductors the current density is greatest near the outside or "skin" of the conductor, a round tube is a more efficient conductor than a round bar. In large capacity buses the conductor configuration which approximates a circle is the most efficient as far as

skin effect is concerned. In flat bar construction, the phase grouping as a unit is subject to skin effect. The current carrying capacity of conductor bars, indoors, not enclosed, 30 C rise above 40 C ambient, is shown in Fig 1. It should be noted that as the number of bars in the side by side arrangement increases from one to four, the allowable amperes per square inch of bus decreases rapidly. With four bars, most of the current is in the two outside bars. More than four bars in a grouping of this type is not economical at 60 cycles.

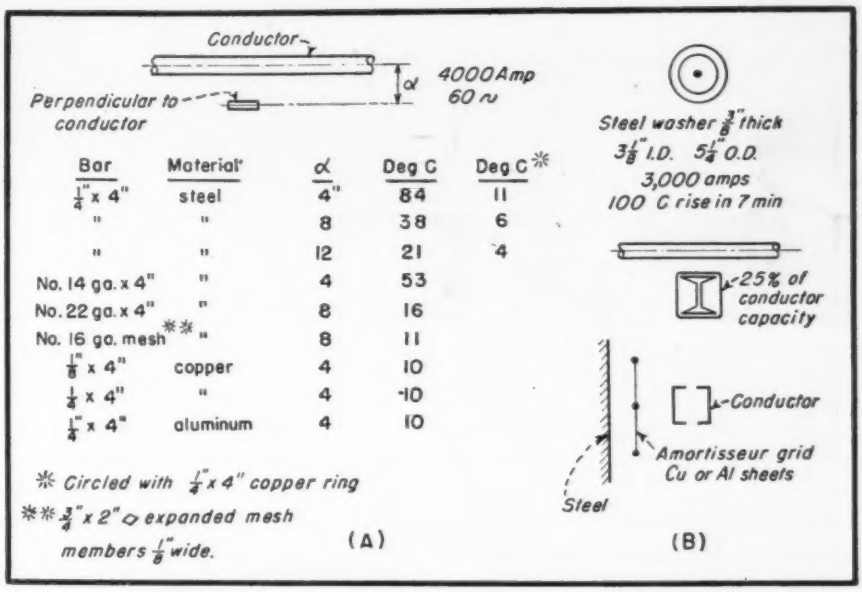
INDUCTIVE HEATING.—Results of inductive heating tests on different materials at various distances from the conductors and for shielding, are shown in Fig 2. This heating results in power losses and voltage drops in the bus. Consequently, there exists the possibility of personal accident, resulting from a workman inadvertently touching a supporting member which is painfully hot. Inductive heating can be controlled by shielding steel members with copper or aluminum, or by using aluminum for supporting members.

CONDUCTOR ARRANGEMENT. — Data supplied by the Copper Development Association, Fig 3, shows the comparative a-c ratings of various conductor arrangements. It is not surprising to find the conventional 4-bar vertical configuration to be the least efficient. The configuration efficiency is affected not only by skin effect, but also by the rate of heat dissipation, produced by both radiation and convection. Radiation is a function of the brightness or color of the conductor surface, as well as exposed area. Its effectiveness, however, is uncertain. Convection is considered the more important of the two. On the basis of heat dissipation, an open bus that is arranged so that the heated air can rise along the inner and outer sides of the conductors is superior to a taped bus.

CURRENT CARRYING CAPACITY OF CONDUCTORS

	Copper						Aluminum					
	¼" x 4" Bars			¼" x 6" Bars			¼" x 4" Bars			¼" x 6" Bars		
	Amp	Amp per Sq in.	Pounds per Ft	Amp	Amp per Sq in.	Pounds per Ft	Amp	Amp per Sq in.	Pounds per Ft	Amp	Amp per Sq in.	Pounds per Ft
¼"	1250	1250	3.85	1850	1233	5.78	1050	1050	1.17	1550	1033	1.76
	2100	1050	7.70	3000	1000	11.56	1750	875	2.34	2500	833	3.52
	2500	833	11.55	3600	800	17.34	2100	700	3.51	3000	667	5.28
	2800	700	15.40	4000	667	23.12	2400	600	4.68	3400	567	7.04

FIG 1 — DATA for unenclosed, indoor conductors rated 30 C rise above 40 C ambient



Bar	Material	α	Deg C	Deg C *
¼" x 4"	steel	4"	84	11
"	"	8	38	6
"	"	12	21	4
No. 14 ga. x 4"	"	4	53	
No. 22 ga. x 4"	"	8	16	
No. 16 ga. mesh **	"	8	11	
⅛" x 4"	copper	4	10	
¼" x 4"	"	4	10	
¼" x 4"	aluminum	4	10	

FIG 2—INDUCTIVE HEATING TESTS: (A) Effect on bars of different materials for various spacings; (B) Methods of shielding

Factors Affecting Arrangement

In selecting the conductor arrangement to use for any given installation, there are several important factors to be considered:

1. Ampere Capacity. After having determined the bus amp capacity, there is a conductor choice ranging from cable up to specially designed shapes. Frequently it is more economical to divide the total current into the largest number of practical components. The ideal bus arrangement is the ring bus with sources and loads tapped alternately. The poorest arrangement is to have all sources at one end and all loads at the other end.

2. Support of Conductors and Spacing of Supports. The available fault current under short circuit conditions is a major factor in selecting the conductor configuration and the type of conductor support. In large power installations the calculated fault current is usually very high. A straight line chart for determining the lateral stresses acting on a conductor under short circuit conditions, made available by Anaconda, is shown in Fig 4. Note that for 10-in. conductor spacing an increase in fault current from 10,000 amp to 40,000 amp increases the lateral stress from 50 to 700 lb per ft of conductor.

Calculated short circuit currents ignore the impedance at the point of fault. In the event of accidental faults on 120/208-v buses, this fault impedance is an appreciable percentage of the total. Some tests have indicated that for this voltage level the actual fault current never exceeds 70% of the calculated value. With consideration of this and other factors, it has been our general practice to assume a maximum fault current of 40,000 rms amp for service bus design, choosing to take that calculated risk in preference to the more expensive complicated design for higher fault current values. This chart is useful for calculating the required section

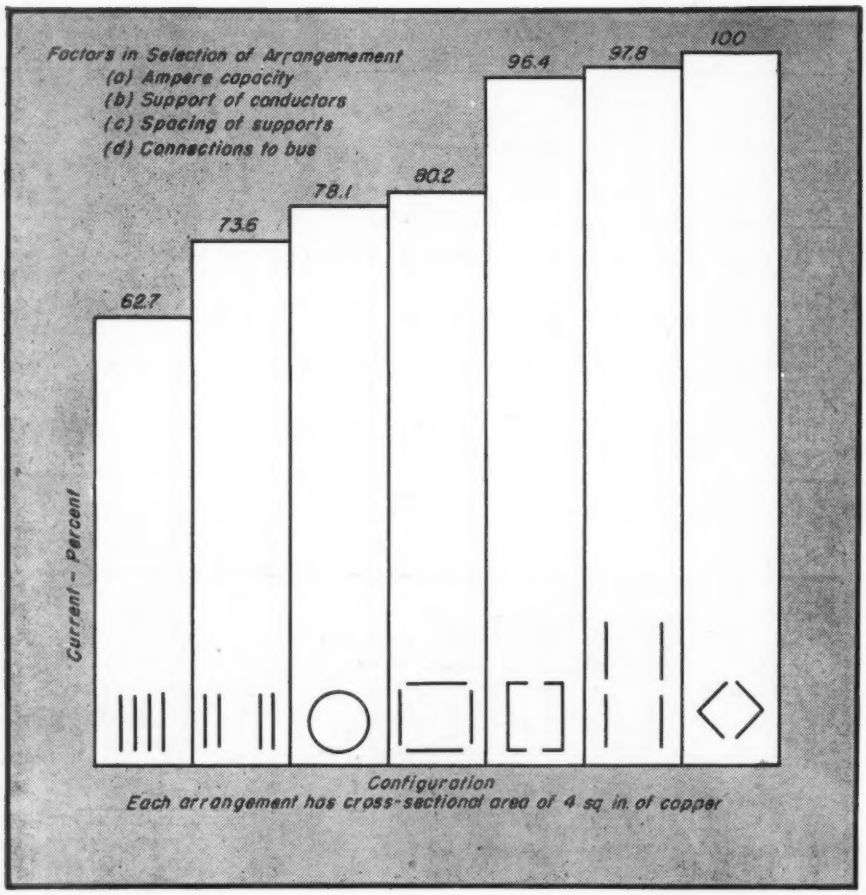


FIG 3—COMPARATIVE RATINGS of various conductor arrangements show commonly used 4-bar vertical configuration to be least efficient

modulus of the bus conductor and the required cantilever strength of the bus supporting insulators.

3. Connections to Bus. Another important factor in conductor arrangement is the cost and ease of making tap connections to the bus. In general, tap connections for vertical bar configurations are comparatively simple and inexpensive with bolted or clamp type connectors; for tubing, either round or square, a bit more expensive; and for square configuration of bars, double channels, and double angles, more expensive and difficult to install. The ease with which future connections can be made to an energized bus should not be overlooked.

These factors were all considered in three installations recently completed in transformer vaults on the Oklahoma City Underground Network System. These examples are not considered as ideal solutions of particular problems, but rather as practical working installations illustrating the problems encountered and how they were solved.

The first was in the Skirvin Hotel where it became necessary to provide service in a comparatively short time. The time element dictated the use of bus materials from stock or available on short delivery.

Fig 5 shows a one line diagram of the installation and a section of the bus. The customer's main line switch, already installed, was rated at 4,000 amp. To handle the present load, it was decided to install two 500-kva 3-phase transformers, with facilities for the third 500-kva transformer, when it should be needed. The equivalent of a 4,000 amp bus was required to equal the capacity of the main line switch. Previous studies had determined that a 4,000-amp bus requires four ¼x6-in. copper bars in vertical configuration, and neither bars nor supports were available in the quantity required. There was on hand a bus complete with supports, consisting of three ¼x3-in. copper bars per phase. This bus had about half the required capacity, so it could be used if the load were taken off the midpoint and the supply to the bus from each end was equal. The customer had a 4,000 amp feeder bus available in sufficient length, so it was arranged that the feeder bus would extend to our middle transformer vault making possible the midpoint connection to the service bus.

The ¼x3-in. service bus was installed from the west transformer vault to beyond the midpoint of the center vault. Current transformers for metering were connected to the bus immediately above the center

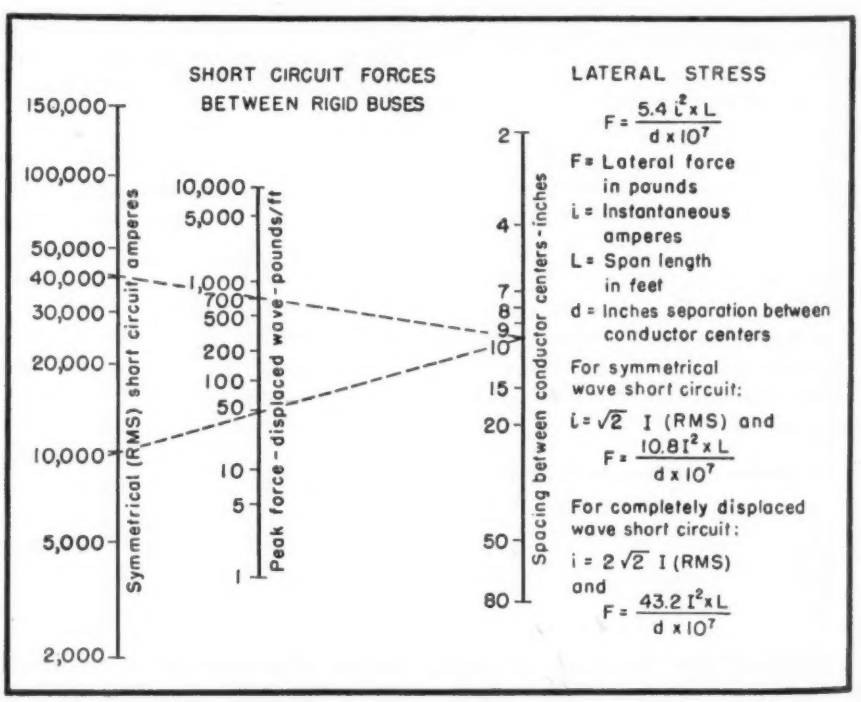


FIG 4—LATERAL STRESSES acting on a conductor under short circuit are determined by straight line chart

vault network protector, and the two 750-Mcm cables per phase from that network protector straddled the current transformer connections to the bus. Four ¼x6-in. copper bars per phase connected the current transformers to the fuses and to the flexible braid connections between the company's bus and the customer's feeder bus. Cables to the secondary network were connected between the two transformer connections.

With this arrangement the split service bus has adequate capacity to handle three 500-kva transformers; and with good ventilation it may not require reinforcement or replacement when the load approaches 4,000 amp and when 750-kva transformers replace the 500-kva units.

The bus section in the middle transformer vault is shown in the photograph. The bus is drilled for extension to the east vault. Note the cable jumpers across the open bus section at the top left. Flexible braids for joining the service bus to the feeder bus at this location will be installed when received. All bus supporting members between the current transformers and the customer's main switch are aluminum, to avoid inductive heating.

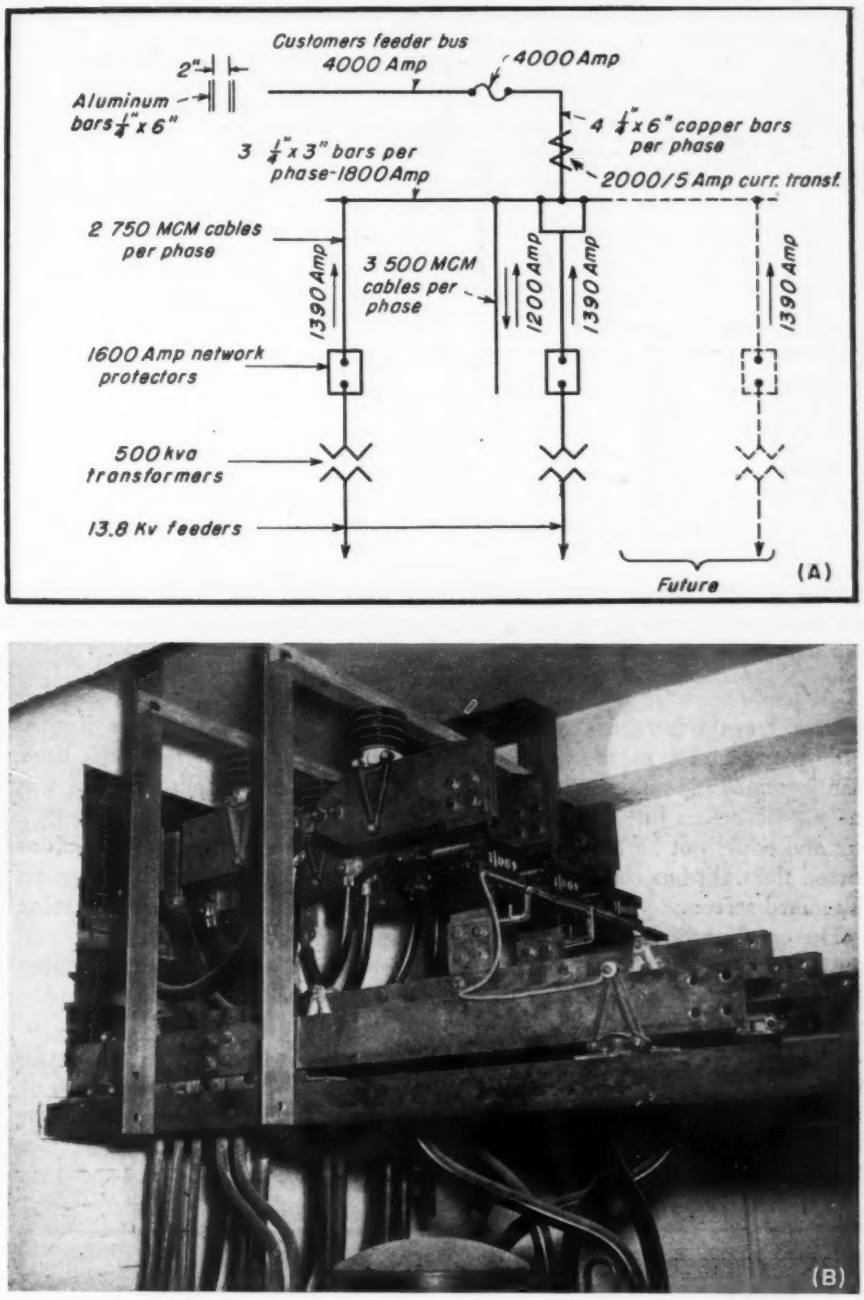


FIG 5—RECENT BUS INSTALLATION for hotel. (A) Connection diagram, including provision for future expansion. (B) Bus section in middle transformer vault. Use of aluminum supports avoids inductive heating

Changes Anticipated

In the west vault, the feeder bus is in line with the service bus and the two buses can easily be tied together at this location. This facilitates current transformer changes and possible service bus reinforcement without service interruption.

In the second example, the Home State Life Building, was completely remodeled. Building plans were changed more than once and it was difficult to determine the electric service requirements. Eventually, the building was completely air conditioned and converted to office space and a theatre. Final plans specified two 2,500-amp feeder buses, which required a service bus of about 5,000-amp capacity.

The one line diagram of this installation and half of the installed bus is shown in Fig 6. The available space for the service bus necessitated a tight vertical bus construction. The bus was split, using three ¼x4-in. copper bars per phase. Connections from network protectors to the bus (a distance of 15 to 25 ft) were made with four sets of 500 Mcm rubber insulated cables per phase per transformer. Leaving the network protector bushings, these cables were grouped into four groups of three cables each per transformer to obtain an A-B-C triangular configuration and thus minimize reactance drop and current unbalance in the parallel phase conductors. This grouping was maintained until it was necessary to fan out the cables for connection to the bus. Two parallel sets of bus fuses and metering current transformers were used. Connections were made from the service bus to the feeder buses above through flexible braid connectors.

Since the bus spacing was close and the supporting members had minimum clearance, all supporting members adjacent to the bus were aluminum to avoid inductive heating. The bus room had to be accessible to the building maintenance men. For this reason the bus and all connections are completely protected with an expanded metal guard screen.

The photograph shows the west side of the service bus. The fuses and

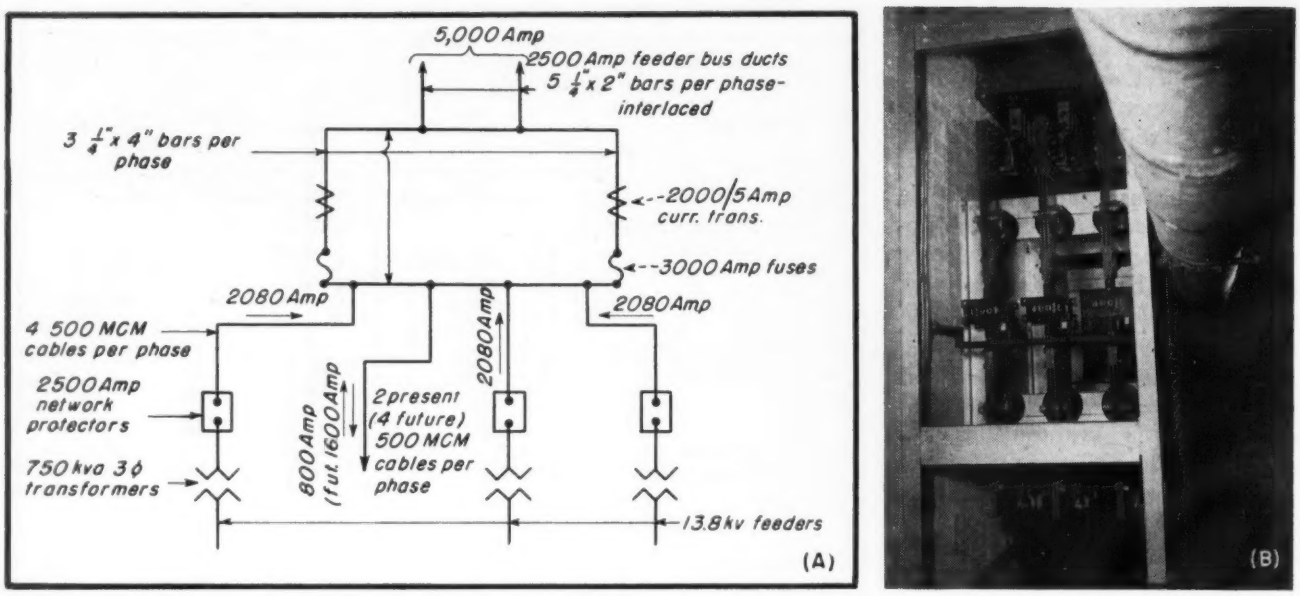


FIG 6—LIMITED SPACE for bus in office building necessitated tight vertical design. (A) Two 2,500 amp feeder buses supply 5000 amp service bus. (B) One half of service bus; screen guards bus from 6-in. steam line

current transformers are duplicated with parallel sets at the east side. The insulated pipe at the right is the main 6-in. steam line for the building and could not be relocated. That forced the tight bus construction and the guard screen.

The one line diagram of the third installation, the First National Bank Building, is shown in Fig 7. In this instance it was decided to replace the existing feeder bus with two 3,000-amp modern low voltage drop buses, and to rebuild the service bus facilities to provide a service bus of 8,000-amp capacity. Providing a bus of this capacity in the limited space available was, for some time, difficult. Finally a split-feed bus was worked out.

Many conductor configurations were studied. Four ¼x6-in. bars on the necessary close phase spacing were slightly inadequate, and also involved a lot of construction labor. Other types of buses were discarded because of the difficulty of supporting the conductors or the difficulty of making tap connections, or both. The type of bus selected was the ventilated hollow square copper tube, 5 in. for the main bus and 4 in. for the metered bus. The current transformer connections are four ¼x6-in. copper bars with phases about 16 in. on centers.

Cable connections at the ends of the main bus were made with lugs bolted to the sides of the square tube. Bar connections to the metered bus and bar taps from the main bus for network protector connections were made with 4-bolt H-clamps. Threaded stud connectors were used on the 3-in. dia network protector bushings, with attached flexible braid connectors for the two ¼x4-in. copper bars per phase to the main bus. Clamp type tee connectors were used for the current transformer taps from the main bus.

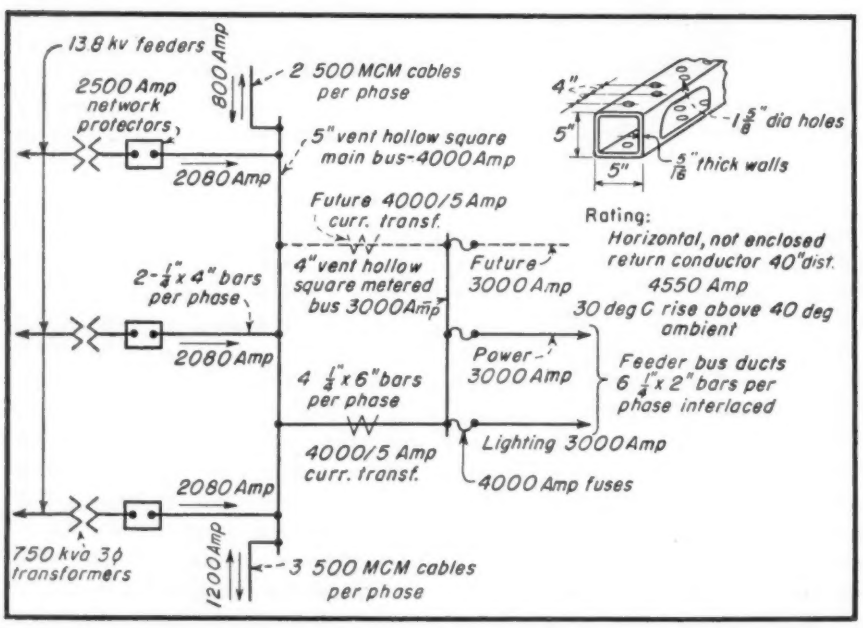
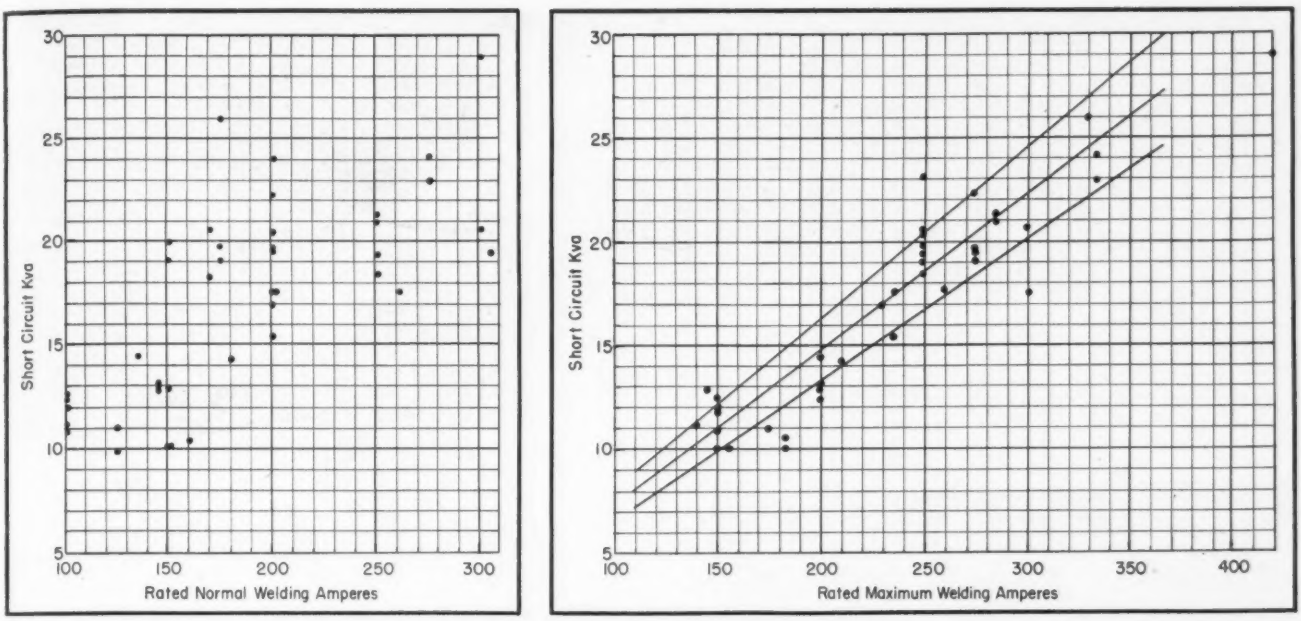


FIG 7—SPLIT-FEED BUS solved problem of supplying 8,000 amp service bus for bank

Maximum 8,000-Amp Demand

The connections to the main bus are so arranged that its 4,000-amp rating should be adequate, under all normal operating conditions, to supply a maximum 8,000-amp service demand. The main features of this installation, shown in the picture on page 90, typify modern bus design. As can be seen, there were many design and construction problems encountered on this job. These illustrations indicate the economy of making adequate provisions for future increased loads. Even more, they emphasize the necessity that factors affecting the design and installation of large buses be given every consideration.



KVA INRUSHES to a-c welders bear little relationship to nameplate ratings of normal welding current (left), but are relatively equal to ratings of maximum current (right). Short-circuit tests proved that nameplate values are no basis for determining power inrush

Rate A-C Welders on Maximum Amperes

BEN R. ASKEW
Industrial Power Specialist
Georgia Power Co, Atlanta

A LARGE PERCENTAGE of transformer-type arc welders are found in small garages, and machine and welding repair shops, where the load of the welder itself is comparatively large. Operating conditions are greatly variable as to type, make and condition of welding equipment. In practically all cases, the industrial type of welder having maximum rating of 350 amp is used.

Users of industrial welders must be served adequately and economically, at the same time eliminating the voltage dips of adjacent customers. The main complication in meeting this situation is the fact that name plate ratings of these devices are not consistent, as between manufacturers and, at times, between products of the same manufacturer.

When the welding electrode touches the metal at the beginning of a weld, a short circuit condition is approached. Approximately 200 tests were made on 37 different types of welders under such conditions. The secondary leads were short circuited at electrode and grounding connections to determine the maximum kva inrush possible to each machine. Results of these tests were plotted against normal ampere nameplate ratings, and also against the maximum welding ampere ratings. On a normal welding current graph, the plotted data were found to be widely dispersed showing that nameplate value is useless as a basis for figuring power inrush of a machine.

Indication of Graph

The points fell much closer together when plotted against maximum welding amperes, indicating that reasonable approximation of service effects can be obtained by using this maximum ampere rating. Through the points of the maximum ampere graph, it was possible to draw a median line, whose equation for a nominal 220-v welder is: maximum kva input $=$ 0.0745 $\times$ maximum ampere output. Lines drawn 10% above and below the median made an envelope inside which all but 12 of the test points are located.

In making the tests, care was taken to attach the electrode clamp firmly to the grounding lug. The secondary leads were twisted together to minimize their reactance, precaution being taken to keep them away from large pieces of metal such as truck bodies or plates and sheets. This procedure assured maximum kva inrush on the primary side. It was from these tests that the accompanying graphs were plotted.

It was recognized that the machine would seldom be set at maximum rating, and that there would be some resistance at the point where the arc originated. Using stop point meters, random tests were also made of machines under welding conditions. The kva inrush was found to be approximately 60% of the short circuit test.

Using the ratios resulting from these tests, it is possible to calculate service effects of welders within acceptable engineering limits. These data can be used for calculating distribution capacities to eliminate light flicker due to voltage fluctuation. For instance, a welder with a maximum rating of 300 amp can have a maximum short circuit inrush of 22.35 kva (300 x 0.0745). Its inrush under usual operating conditions is 13.4 kva (22.35 x 0.6).

RUNOUT TABLE DRIVE in steel mill. Each roll is individually driven by a 4-hp shunt-wound, d-c adjustable speed, totally enclosed, watertight motor. The speed at which each section operates is governed by the voltage supplied to the motors

Applying Shunt Motors To Adjustable Speed Loads—II

Operating characteristics for different methods of controlling speed of shunt d-c motor and their application to typical adjustable speed loads

R. B. IMMEL
Control Engineer
Westinghouse Electric Corporation
East Pittsburgh, Pa.

BASED on the fundamental relationships discussed in ELECTRICAL WORLD, November 20, 1948, page 94, different methods are used to control the speed of a shunt d-c motor. These include speed adjustment by: Armature resistance; different methods of field excitation; and combination of armature and field control.

Armature Resistance Control

CHARACTERISTICS: *Speed range.* 2 to 1 with 50% speed reduction by armature resistance control; *Speed change.* Speed decrease from no load to full load, approximately 50% at low speed and 10% at base speed; *Horsepower.* ¼ to 50.

For armature resistance control, usually the motor operates with full shunt field strength. Typical speed-torque curves for a 10-point controller with a class No. 93 NEMA resistor for varying torque applications are shown in Fig 8. This resistor class provides 50% speed reduction with at least 35% of full load torque on the first point. Regulation is poor, varying from about 120% at low speed to about 10% at the rated full-load speed. Additional intermediate speeds can be obtained by using more resistor steps. NEMA class No. 95 resistors are used for constant torque

applications that provide 50% speed reduction with not less than 80% of full load torque.

A superimposed speed—torque characteristic of a fan load is shown. When voltage is applied with all resistance in the armature circuit, the motor will be accelerated on the first point to a speed indicated by *W*. When the first resistor step is shorted out on the second point, the motor will then increase in speed from point *W* to point *X*, then to *Y*; and ultimately to point *Z* with no resistance in the armature circuit.

For speed reductions below 50% of the rated speed, the armature can be shunted by a resistor. This greatly improves the regulation and reduces the differential between the no-load and full-load speeds as shown in Fig 9. When the percent of the impressed voltage value on the armature is known, the percent of base speed can be found for both no and full loads from Fig 6 (Part I). Although an armature shunting resistor gives good speed control at low speeds, it is not efficient since energy is dissipated in the resistors. Curves in Fig 9 are for the same full load speed for either method of control.

Field Excitation Control

CHARACTERISTICS: *Speed range.* 4 to 1 speed increase by field control; speed change: *Speed decrease.* From no load to full load approximately

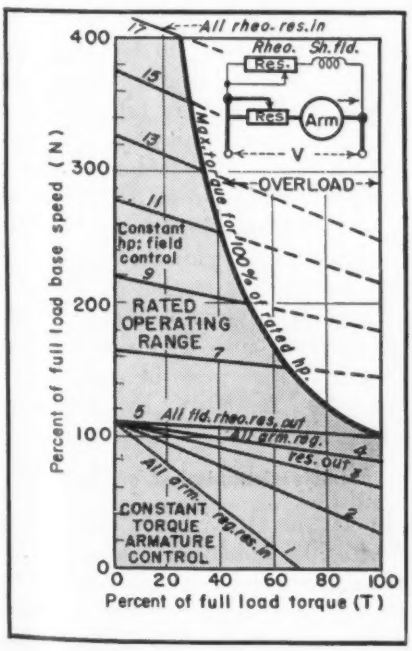


FIG 10—FIELD CONTROL usually provides 4 to 1 speed adjustment

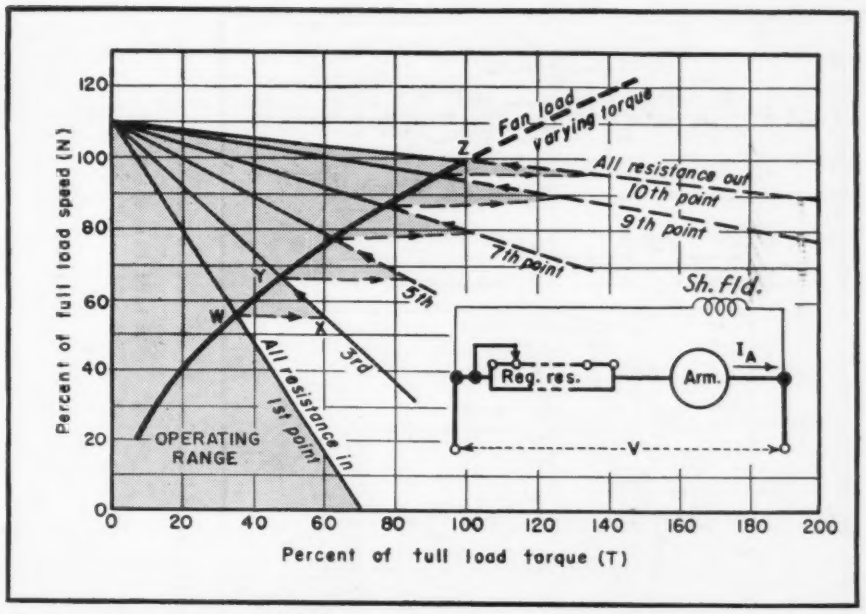


FIG 8—ARMATURE RESISTANCE is simple way to adjust speed

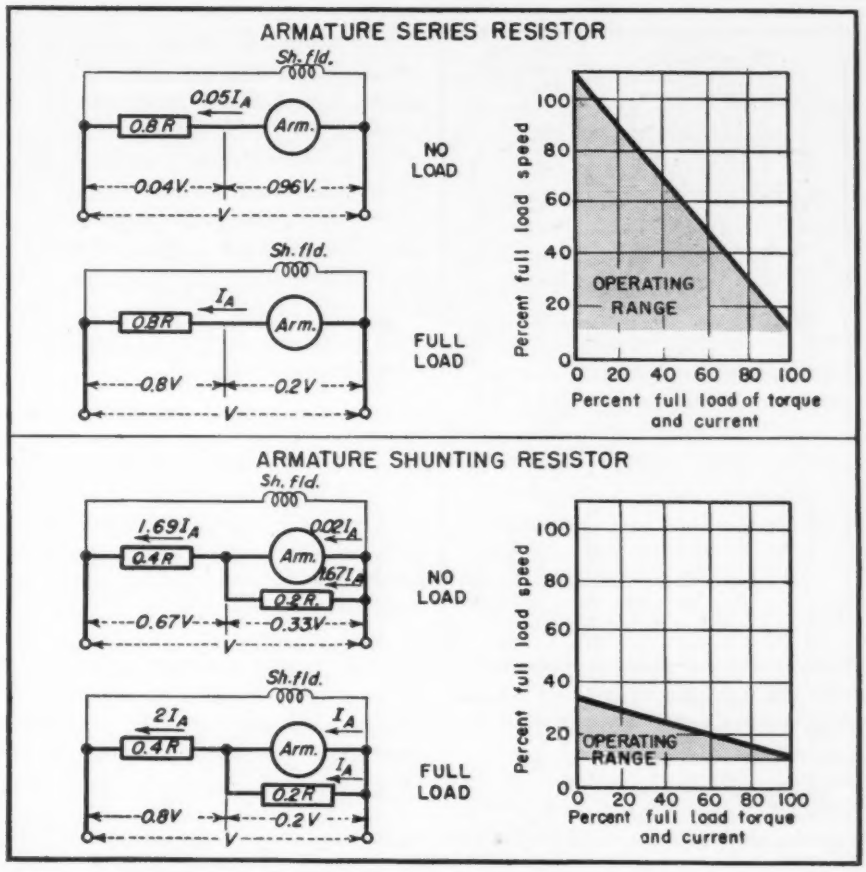


FIG 9—SHUNTING ARMATURE by resistor improves regulation

10% at base speed and 25% at high speed; *Horsepower.* Unlimited.

Speed-torque characteristics of a d-c drive motor with a multi-point field rheostat are shown in Fig 10. Intermediate speeds can be obtained by using a rheostat with smaller resistance steps. Regulation is best at the base speed and increases as the speed increases. Since this drive has a constant horsepower characteristic, the safe drive torque available decreases as the speed increases, as shown. For motors with a tapered or 1-hr-hp rating, maximum torque is greater than shown. In general, mag-

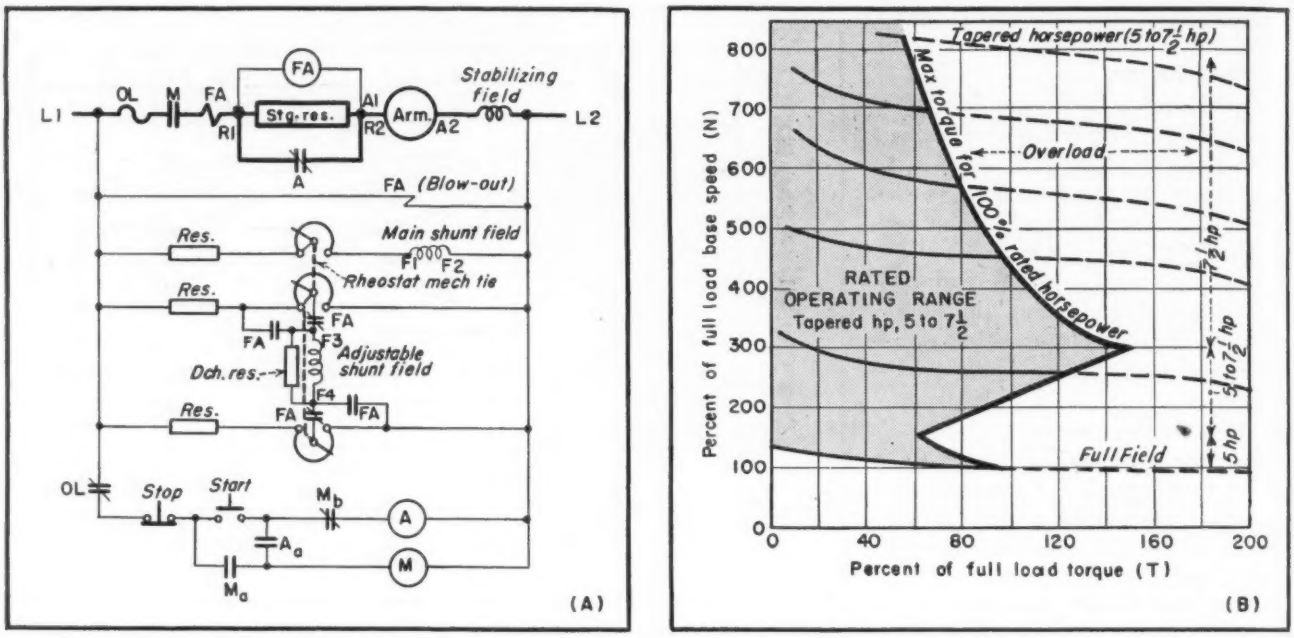


FIG 11—DUAL FIELD control gives 8 to 1 speed range: (A) Schematic circuit, (B) Operating characteristic

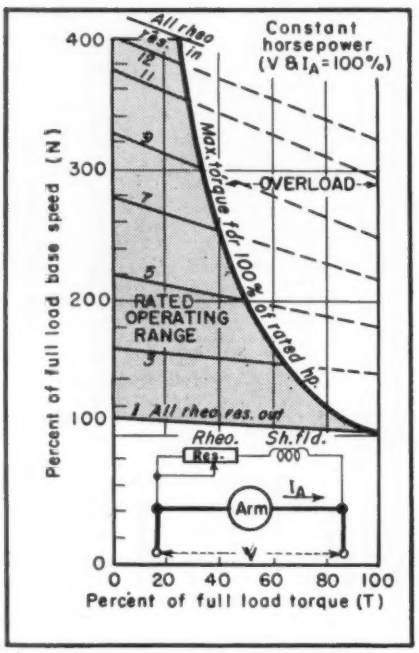


FIG 12—COMBINATION field and armature resistance control increases speed range

netically operated starters are used because of ease for remote operation, interlocking, and overload protection.

Dual Field Excitation Control

CHARACTERISTICS: *Speed range*, 8 to 1 speed increase by field control; *Speed change*. Speed decrease from no load to full load approximately 15% at both base and high speed; *Horsepower*. 1 to 40 (40 C continuous), 1—1½ to 40—50 (40 C continuous operation, tapered horsepower), 1½ to 50 (50 C 1-hr operation).

By using a d-c motor with a double field stator, and a two circuit armature, 8 to 1 speed range can be obtained by field excitation control. This construction and mode of operation minimizes the factors that normally limit the speed range of standard shunt motors such as: changes in residual magnetism, field distortion, demagnetization of the main field by the armature, and an increase in the reactance voltage.

Strong Field Maintained

Essentially the 8 to 1 motor maintains a substantial value of field flux, even at high speeds. Because of the 2-circuit armature winding, there are only two circuits between brushes of opposite polarity. The voltages generated in the coil sides under each of the four poles add algebraically between the brushes of opposite polarity. Coils on two main poles form one field winding and coils on the two lower adjustable field poles form a second field winding. The main field winding substantially provides a strong constant magnetic field. The flux of the adjustable field is changed from full field cumulative to the necessary differential value. Higher efficiencies and better regulation are secured by varying the main field flux down to 60% of normal full field. The main field is placed at the top of the frame so the upward magnetic attraction will reduce the thrust of the armature on the bearings.

As shown in Fig 11 (A), the rheostats are connected mechanically to automatically insure optimum field conditions. When the field accelerating relay *FA* operates, the adjustable shunt field automatically supplies a maximum value of field flux that adds to the main field. This permits the motor to produce substantial torque with relatively low armature current.

The typical speed-torque curves for a 5-7½ tapered horsepower rated motor with a 450-rpm base speed in Fig 11 (B) show good regulation over the entire speed range. The motor has a 5-hp continuous operation rating with a 50 C rise from 1 to 1½ times base speed. From 1½ to 3 times the base speed the horsepower tapers from 5 to 7½ hp for continuous operation with 40 C rise. The motor develops a constant 7½ hp from 3 to 8 times base speed with 40 C rise. The safe maximum torque for the motor without overloading is shown. This adjustable speed drive is well suited for applications such as machine tools. Generally it reduces the gearing and improves flexibility by providing practically a stepless speed range.

Combination Method of Control

CHARACTERISTICS: *Speed range*. 8 to 1 with 50% reduction by armature resistance control and 4 to 1 speed increase by field control; *Speed Change*. Speed decrease from no load to full load approximately 50% at low speed, 10% at base speed and

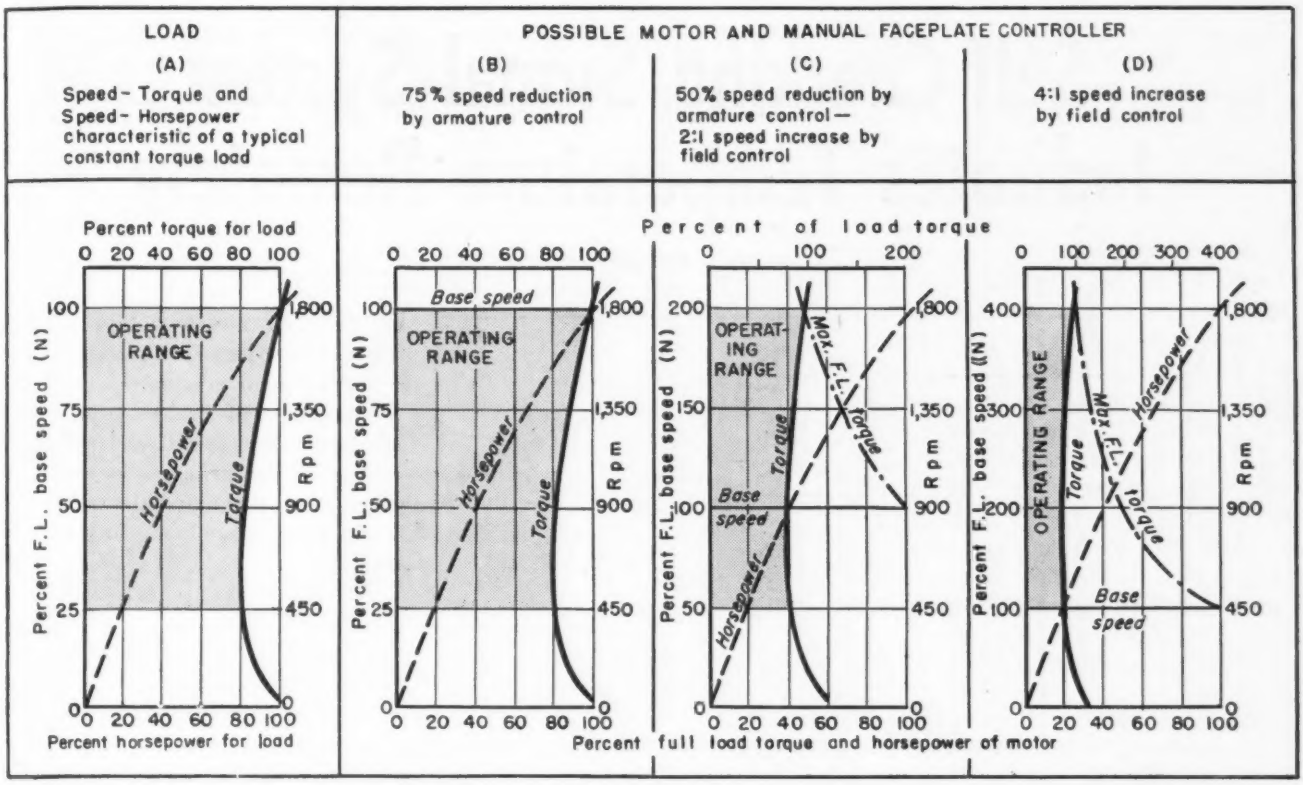


FIG 13—GRAPHICAL METHOD comparing shunt motors driving a typical constant torque load. Shaded areas show utilization

25% at high speed; *Horsepower.* ¼ to 50.

The speed range of a d-c shunt motor drive can be greatly increased by using both armature resistance and field control means.

This type of d-c drive is for constant torque and constant horsepower applications. The speed-torque curves in Fig 12 show a drive with five points of armature resistance control and a typical number of field control points. Intermediate speeds can be obtained by using more points or steps. Speed regulation is best at the base speed and poorest for lower speeds.

Graphical Analysis

In selecting the proper drive such factors as speed range, size, cost and regulation must be considered. A graphical analysis of a typical application for applying a d-c shunt wound motor to a constant torque load that requires speed adjustment from 450 to 1,800 rpm, is shown in Fig 13. The table compares some of the factors for different 10-hp drives which are shown in Fig 13.

The speed-torque and speed-horsepower requirements of the load are shown in (*A*). The application of a constant speed shunt wound motor with 75% base speed reduction by armature resistance control is shown in (*B*). The drive meets the load torque requirements and is the lowest in cost, but relatively the speed regulation is very poor and the number of speed points is limited. Standard drives using armature resistance control are recommended usually for only 50% speed reduction. But by carefully selecting the motor and using an armature shunting resistor on the lower speed points, usually the desired speed reduction can be obtained.

Comparison of Size, Cost and Weight of Different 10-Hp Drives Shown in Fig 13

	Drive B	Drive C	Drive D
Motor frame size.....	43 SK	83 SK	103 SK
Complete cost, %....	100	153	207
Complete weight, %..	100	156	182

A drive using a constant speed motor with speed adjustment by both armature resistance and field control is shown in (*C*). As shown, the armature regulating resistor needs capacity for only 40% of the rated horsepower at the base speed.

A drive using an adjustable speed motor for 4 to 1 speed adjustment, by control of the shunt field excitation only, is shown in (*D*). This drive gives good speed regulation and provides a relatively large number of points. The cost, weight, and size of this drive is considerably more than that of the other two; and full horsepower rating of the motor can be utilized only when the motor is operated at maximum load speed. In general, the higher the base speed of a shunt motor, the smaller the motor frame size and the lower the cost.

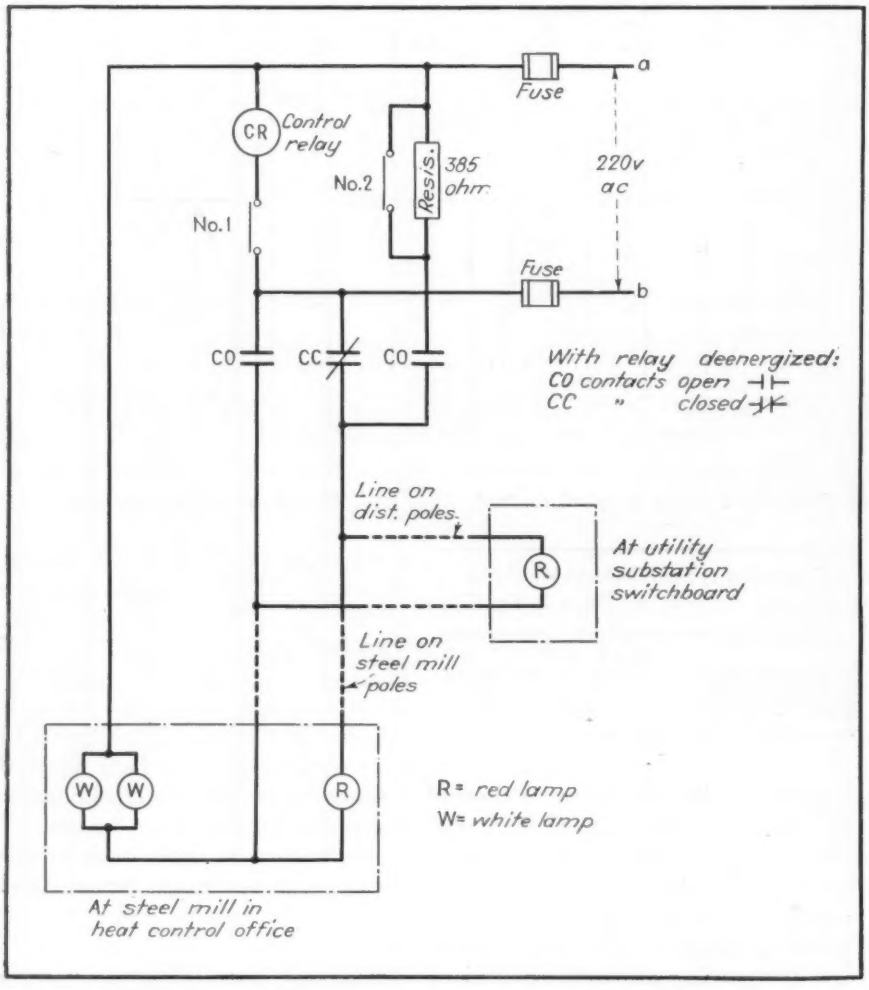
A graphical analysis, such as discussed, is a good way to compare and select the most economical and satisfactory drive.

Although shunt motors are especially useful for adjustable speed drives, other types available provide a variety of operating characteristics. These include: Single-phase a-c capacitor motors for fan drives; three-phase wound-rotor a-c motors for big hoists; a-c series wound motors for stoker drives; and 3-phase adjustable frequency squirrel-cage motors for group motor drives used in nylon spinning.

A comprehensive 2-page chart, now in preparation for a future Engineering Reference Sheet, will compare basic characteristics of the other types of motors for adjustable speed drives. Factors compared include: Relative order of simplicity, speed and cost, and degrees of speed adjustment.

Self-Checking Signal System Indicates Temperature Remotely

JOHN I. HURSH, Auburn, Ind.



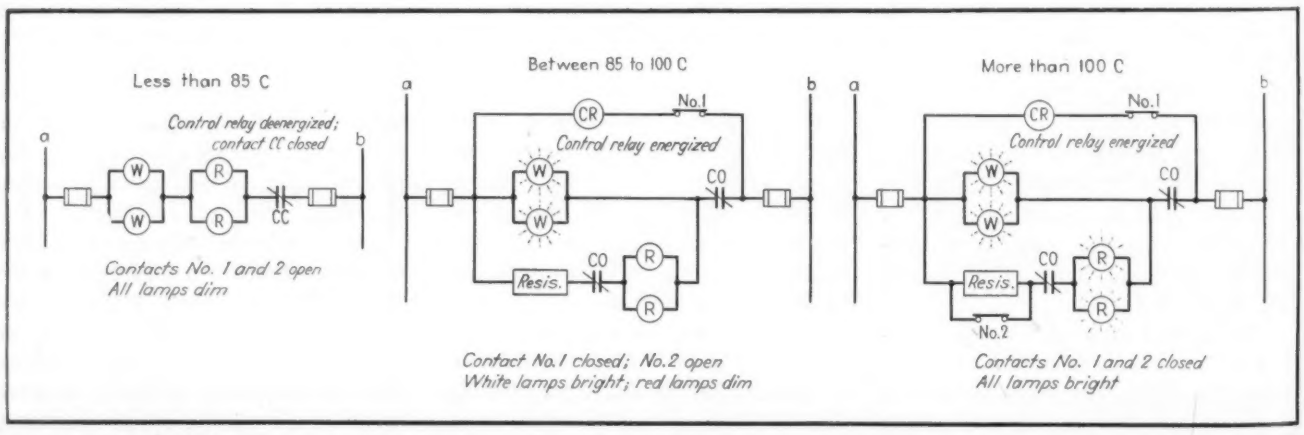
SIGNAL CIRCUIT when both contacts No 1 and 2 are open. Contacts shown for one transformer only. Circuit to nearby utility substation is carried over fairly small wire with little voltage drop

A BANK OF THREE 2,500-kva transformers served a steel mill furnace load adequately until different grades of steel were produced, which required some overlapping operation of the furnaces. To avoid operating at damaging temperatures, transformer hotspot detectors were installed.

The system shown registers a combination of oil temperature and load temperature. The system operates a visible temperature indicator at each transformer and also a self checking remote temperature alarm.

By the system, the furnace heat control operator at the steel mill can check on the transformer temperature at every step; also, the utility supplying the power can see the approach of a dangerous temperature. The signal system is self supervising. All lamps in the system burn at all times, regardless of what temperature is being indicated. A dark lamp indicates a failure in the signal circuit or a burned out lamp.

Temperatures less than 85 C cause all three lamps to burn dimly. When the temperature of any of the transformers exceeds 85 C but less than 100 C, contact No. 1 closes to energize the control relay and the clear lamps become bright. For temperatures above 100 C, contact No. 2 closes and the red lamps become bright.



CIRCUIT CONDITIONS for the three temperature ranges. Energized control relay closes contacts CO and opens contact CC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

TRUCK-MOUNTED CRANE designed and built by Portland General Electric has capacity of four tons, with power take-off from truck engine

Versatile Crane Speeds Construction

C. J. SCOVILLE
General Foreman,
Electrical Maintenance Dept
Portland General Electric Co
Portland, Ore.

To STEP UP small substation construction, Portland General Electric has designed and built a versatile truck-mounted crane. Excellent mobility and ample capacity of the crane have materially aided placing and erection of structural framework, transformers and other substation components.

The unit is made up of a commercially built 4-ton crane mounted on a 2-ton truck chassis. Power for the crane is supplied by a power take-off from the truck. The 21-ft boom is rotated through 360 deg by power from the same take-off. A hydraulic pump, also driven by the truck engine, supplies power for a hydaulic ram which raises and lowers the boom loaded or unloaded.

Hydraulic jacks on swiveling outriggers are located at each of the four corners of the truck platform. These provide the added stability of a base 14-ft square so the loaded boom can be rotated to any position. Individual hydraulic controls for the jacks are located in the truck cab with the other controls. The outriggers are swung into position by hand and the operator lowers and raises the jacks simply by operating four levers.

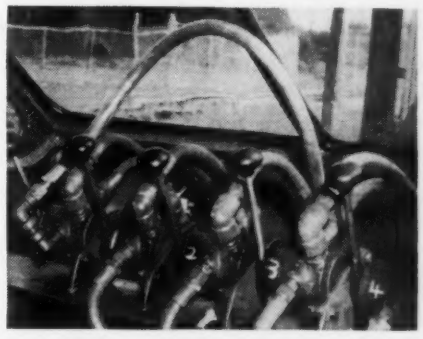
4-Ton Capacity

Normal capacity of the crane is 4 tons. It can handle transformers up to 150 kva, and is often used for placing transformers and regulators on pole platforms. With an extension boom it can lift up to 35 ft above the ground.

A 5-ton pulling winch to assist in moving and placing equipment is mounted on the rear of the truck. It also is controlled from the cab and driven by a power take-off from the truck.

Controls Carefully Placed

Careful attention was given to ease of operation in planning the controls in the cab of the truck. The seat on the right side of the cab was reversed so the operator could see the crane at all times. With the aid of dual throt-



OPERATING CONTROLS for the boom and hydraulic jacks. Driver has dual throttle, clutch and brake control, and can operate truck from reversed seat on right side of cab

Capacitors?

"We could not have gained system capacity as quickly and at as low a cost in any other way"

PACIFIC GAS AND ELECTRIC COMPANY

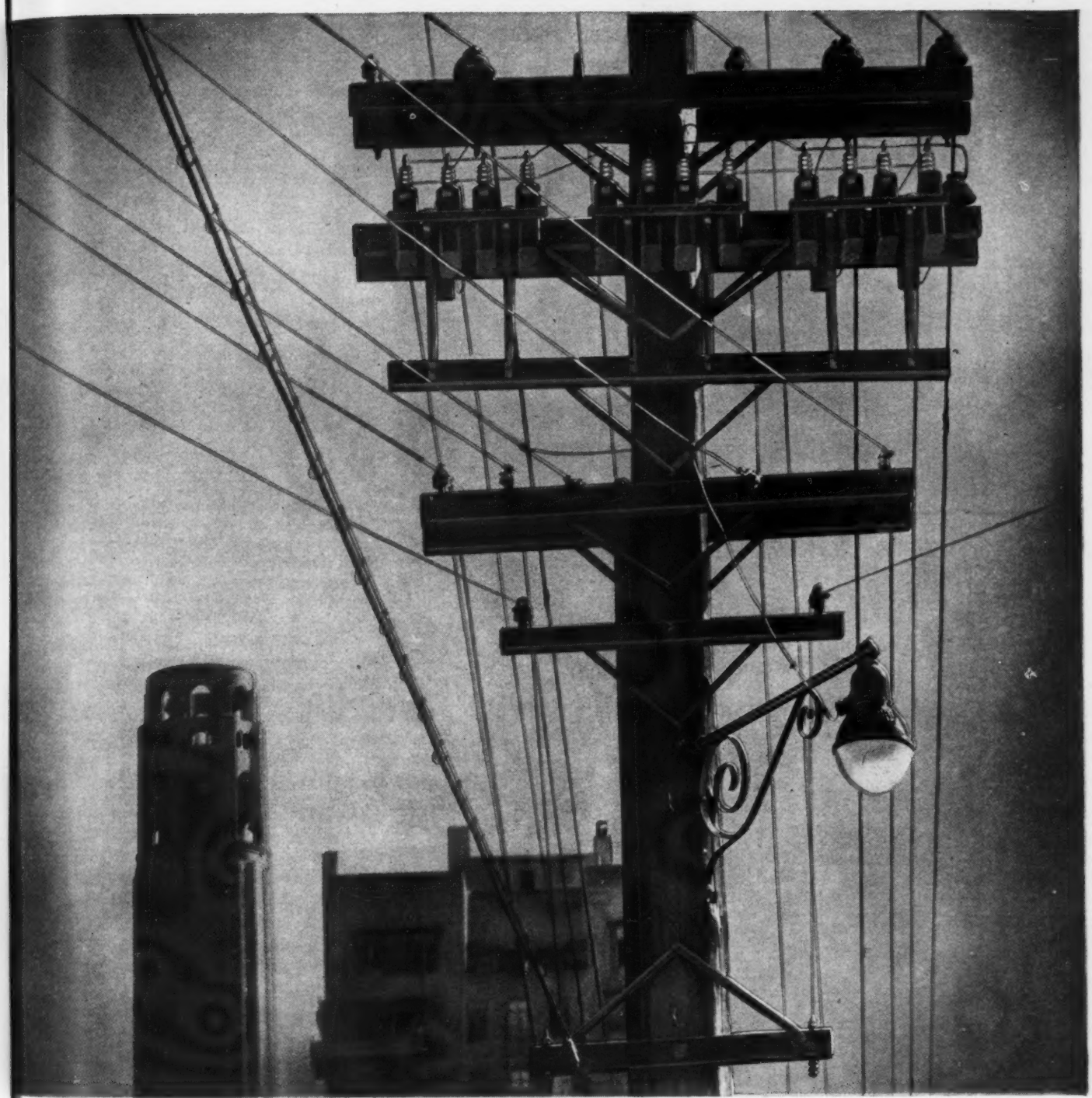
This is the story that Pacific Gas & Electric Company tells about capacitors:

"The tremendous growth of industry, and the increase of population in the California area served by our system in the last few years, has made it necessary for us to install capacitors on our system equal to approximately 20% of our system peak load.

"Capacitors, while more than justified by economic reasons have aided us materially in carrying our load during this interval of rapid growth. We could not have gained system capacity as quickly and at as low a cost in any other way.

"Like other utilities we found that the expected drop in load at the end of a shooting war did not occur and we were, therefore, faced with the problem of immediately enlarging our system capacity. Major substation increases required long and careful planning plus long intervals of time to procure necessary equipment. Constant review of load in our three operational areas showed that our transmission and distribution system was being overloaded with low power factor loads.

"Obviously, with capacitors readily available from American manufacturers at a cost of less than $10 per KVAR installed, we availed ourselves of the opportunity to correct system power factor as a whole and thus relieve system overloads and release capacity for



Typical pole-line capacitor installation of Pacific Gas and Electric Company, with Coit tower in background

rapidly increasing loads.

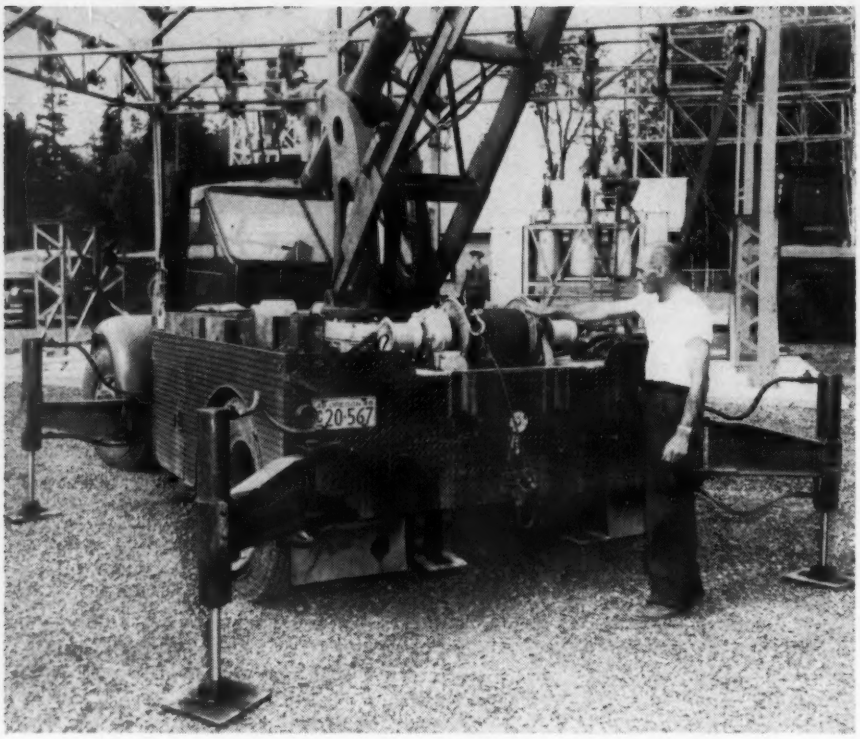
"This has been a wise program and almost continuous surveys in our three operating areas have been maintained since the end of the war. As a result of these surveys we have installed on our system approximately 20% of system peak load in capacitors.

"Capacitors have made our system operation more efficient and less costly through the elimination of wattless energy and have helped correct for voltage drop, thus giving our customers better service. We believe the investment in added system capacity through the use of capacitors has been well justified and will be a continuing program."

The purpose of these advertisements is to encourage electrical utilities to exchange information on the use of power-factor-improvement capacitors. We believe that such an exchange will best bring out that capacitors can be used much more widely than at present—that they provide the fastest way of increasing peak-load capacity—that they can bring many utilities extraordinary returns by increasing capacity of existing distribution lines, transmission lines, transformers and circuit breakers—and that they offer one of the best possibilities of scaling down system costs per kilowatt. If your experience with capacitors would be of interest and value to other companies, we would like to hear from you. Contact your G-E Representative or write *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

407-11



HYDRAULIC JACKS on swiveling outriggers at each corner of the truck, give an effective base 14 ft square for greater stability regardless of boom position. Five-ton pulling winch helps in shifting and locating equipment. Winch is driven by power take-off from truck and from cab

tle, clutch and break controls, he can maneuver the truck either from this seat or from the conventional seat behind the steering wheel.

A Big Improvement

After a year of experience with this extremely versatile tool, Portland General Electric has found it offers a big improvement over other methods used for light construction. It has proven to be a big saver of time and physical effort in erecting structural steel platforms and switchgear, assembling large transformers and radiators and performing many other construction jobs.

Scheduling Pole and Line Inspection—II*

THE COMPANY inspects every street light pole at the ground line at the end of the first 15 years of its life and at least once every five years afterward for estimating the degree of corrosion. Between Jan. 1 and March 1 annually at the same time as the wooden poles are to be butt inspected, the company marks with a green metal clip all cards corresponding to new steel poles due for their first inspection the following year or to steel poles due for inspection under the 5-year limit in the following year.

Pole record slips are prepared as in connection with the wooden poles previously mentioned. These slips are filed separately from the slips for wooden poles until the inspector is ready to start his annual examination of the distribution system.

General Line Inspection. For wooden poles this operation starts annually about March 25 and is completed about Nov. 1. On this tour the pole inspector makes such minor repairs as his equipment and the help of one first-class lineman will allow without extending the inspection beyond Nov. 1. He reports all other needed repairs. He is expected to replace defective or missing house brackets, pole numbers, incandescent lamp shades, fuse boxes, doors to lamp bases (excluding 1,000-lumen incandescent units) or other similar needs, and to pull up slack wires, replace defective pins, insulators, service brackets and other damaged equipment.

LINE AND SERVICE INSPECTION REPORT

Use this form for reporting all conditions not covered by Pole Record Form

At ..... Street

Near Pole No. ..... Block No. .....

Excessive sag	Poor wiring on building
Dead Service loop	Main fuse shunted
Serious tree interference	Unmetered current
3-wire neutral under fused	Meter or meter box incorrectly wired
3-wire system obviously unbalanced	Material stored in transformer vault

Inspected by ..... Date reported ..... 19 .....

Work Order # ..... Date W.O. started ..... 19 .....

By .....

TYPE of line and service inspection report used to record poor overhead conditions on distribution system. Form is 5½ x 7¼ in.

Unauthorized Attachments

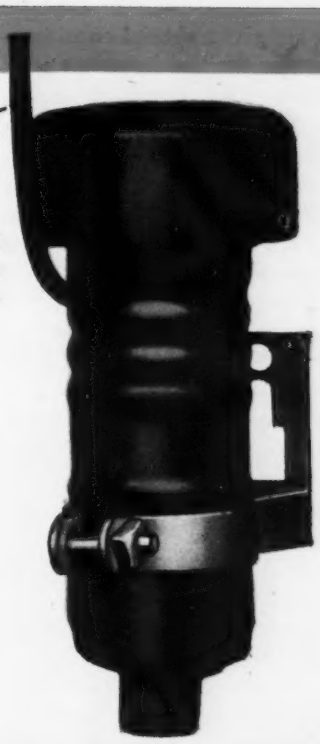
In addition the inspector notes and reports all poles to which unauthorized attachments like clothes lines or radio aerials have been made. He is not allowed to remove such attachments. Notation is made of any new pole set by the power company which has not been marked with a dating

* Continuing a five-article series which began in ELECTRICAL WORLD, Nov. 20, 1948.

extra protection!

PELLET ARRESTERS

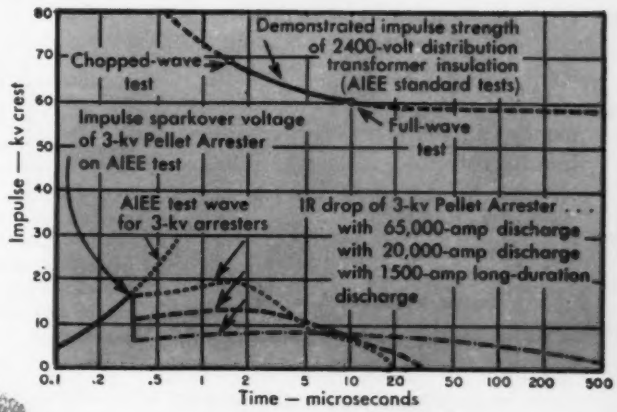
The quality-standard of the industry for more than 25 years.



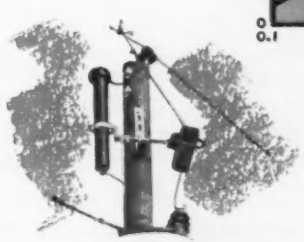
The Pellet is a *valve-type* arrester for universal use on urban, rural, or industrial systems — available in ratings of 1-kv to 15-kv, inclusive.

LOW SPARKOVER AND LOW IR DROP GIVE YOU EXTRA PROTECTION. With a valve-type arrester, the protection afforded transformers and other equipment is dependent on both sparkover voltage to start discharge *and* the IR drop across the arrester *during* discharge. The latter depends on the ability of the arrester valve-element to decrease its resistance with increase in discharge current.

With G-E pellet arresters, initial sparkover voltage is low—for a 3-kv pellet arrester, for example, less than ⅓ of the AIEE impulse test level of 2400-volt transformers. And—the *exceptionally low* IR drop, at low, medium or high lightning currents—is a distinctive feature that gives *extra protection* compared to any other valve-type distribution arrester.



EXTRA DURABILITY — BUILT IN. G-E pellet arresters defy moisture. Pellets, themselves, are of lead peroxide—a distinctive valve material whose characteristics are unaffected by moisture. And, dry nitrogen (N_2) is sealed into the gap-chamber of all G-E pellet arresters—an exclusive G-E feature. This dry inert gas prevents formation of ozones or oxides—keeps the gap electrodes bright as new during years of service operation. Ask for Bulletin GEA-2975D, *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



GENERAL ELECTRIC

405-30

nail, and the pole is so marked during the inspection.

Note is also made of any location in which any considerable amount of weatherproof insulation is hanging from the line wires, with special emphasis on any sections where the wire has been left bare. All privately owned poles are investigated and company initials removed from such poles and crossarms. Company painted initials to be removed are covered with thick green paint.

Creosote treated poles in exposed locations are given special consideration whenever the line inspector is in their vicinity. If a pole is in such a condition that the clothing of a passerby may be damaged either by excess creosote or by splinters left by spurs, the line inspector attends to it. Splinters are removed and the pole surface smoothed.

Trees on streets and in public parks, except trees obviously not planted as shade trees, are not allowed to be trimmed by the line inspector. He notes all cases of tree interference. Trees on private property may be trimmed provided permission is first secured from the person legally in charge of the property. The line inspector is not allowed to perform extensive trimming work, but handles minor requirements only.

Transformer Sites Inspected

The line inspector looks for visible trouble in all transformer installations mounted on ground platforms or bases, except 13.2-kv banks. This checkup includes fencing around transformer installations. He reports all unsafe or insecure conditions on or about such installations. These include weak posts, missing or defective gates, pickets, hasps or padlocks. He also notes and reports any defective or dangerous structures used to support constant-current transformers or other company apparatus.

Other objectives are the painting of any unpainted standpipes, checkups of all important taped joints and their painting if needed (especially at standpipe tops), and the condition of visible manhole or tilehole castings and covers. Cracked or broken units are reported, along with those projecting above the ground surface in such a way to be a hazard to pedestrians or vehicles. The inspector notes all cases where wires at the top of a standpipe may be reached by children standing on roofs, fences or walls. On receipt of such a report the company starts a work order to inclose wire of this sort with a conduit of standard fiber construction.

Protecting Transformer Windings Against Lightning

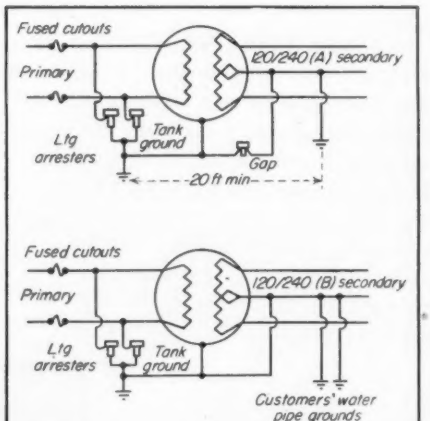
DISTRIBUTION TRANSFORMER interconnections on Central Maine Power circuits are established to prevent transformer fuse or bushing failure due to lightning. Even in areas where effective grounds are not practicable, outages are usually avoided.

This is done by limiting the surge voltages that can be impressed on primary or secondary insulation to magnitudes well below the insulation strength by lightning arresters or gap. Due to the relatively higher breakdown voltage of the gaps it is not considered good practice to use them on older transformers. The establishment of a good ground provides maximum protection, although the effectiveness of the ground itself is not critical in insuring the success of an interconnection scheme.

Surge Voltages Limited

In the connections shown, the lightning arresters limit the surge voltages impressed on the primary insulation. Voltage across the secondary insulation is safely limited by the flash-over voltage of the gap.

The company considers that the direct grounding of the transformer tank is at all times desirable. This fixes the tank at ground potential. Otherwise, with the tank apparently carefully insulated there is no assurance that it may not be accidentally grounded. Tank grounding is specially desirable with 4.8 or 7.2-kv primaries. This is because an accidental connection of the primary to the ungrounded tank may put the tank at full primary voltage above the secondary, which is usually grounded in most installations. The 120/240-v secondary insulations are tested at lower potentials than these primary voltages.



CIRCUIT CONNECTIONS when: (Top) Customers' grounds are driven rods and primary is delta-connected. With a multi-grounded wye primary, omit cutout and arrester on neutral line and also the gap. (Bottom) Customers' grounds are to continuous water pipe and primary is delta-connected. When primary is multi-grounded wye, cutout and lightning arrester on neutral line are omitted

For Westinghouse CSP and General Electric HSBA transformers a tank grounding gap is furnished by the maker. This is equivalent to placing a gap in the arrester ground lead as shown in the diagram. While the use of this gap on the transformer is necessary to insulate the tank from ground, its employment is not suggested by Central Maine Power unless such insulation is considered desirable by the operator. When a standard lightning arrester is gapped to ground as described above, only modern arresters designed to have zero leakage current at normal voltage are used. If a multi-grounded neutral is available, the arrester on the neutral will always be omitted and the tank-to-ground gap may be omitted.

If the tank grounding cap is used, it is recommended that the lead to it from earth be kept free from the pole for several feet. Otherwise a wet pole may establish a leakage path from the ground lead to the tank, putting the tank accidentally at ground potential. The scheme illustrated gives maximum protection regardless of the resistance or length of any ground connections, since the surge voltages are definitely limited in value. Transformer protection is then independent of the presence or absence of a ground connection.

NARROWER VAULTS G-E standardized network equipments are designed for vaults with widths of only 4½ feet—or less. Such vaults can almost always be built between building line and curb—the best location from the standpoint of real estate, construction, and servicing. Such narrow vaults reduce appreciably the problem of roof-slab construction.

REASON: G-E standardized network equipments require servicing only from the two ends. The network protector is located on the low-voltage end—can be slid out on rails from its housing for ready inspection or adjustment. All transformer accessories, as well as the high-voltage switch, are located at the high-voltage end—liquid-level gages, thermometer, pressure test valves, tap changer, drain valves, sampling valves and filter press valves can all be inspected or operated from this end.

SHALLOWER VAULTS With G-E standardized network equipments, vaults can be as much as one or two feet shallower—saving substantially in excavating and construction costs. Vault drainage is also simplified—though either the vault type or the subway type transformer can be completely submerged without damage or interruption of service.

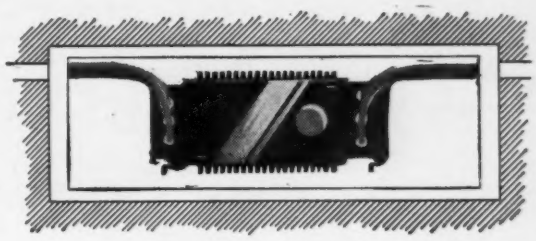
REASON: With G-E standardized network equipments, both high- and low-voltage cable terminals are well below the top of the transformer. Even in these shallow vaults there is room for large-radius bends of cables.

PLUS

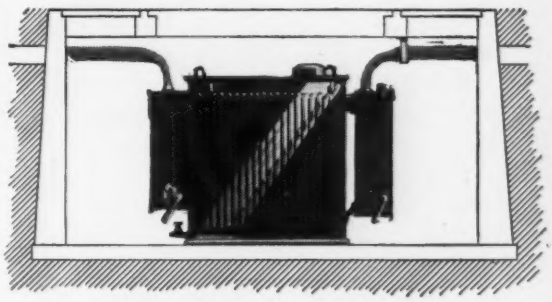
FASTER DELIVERY G-E standardized network transformers and protectors can be supplied on shorter delivery.

LOWER PRICE G-E standardized network units are appreciably lower in price than non-standard designs.

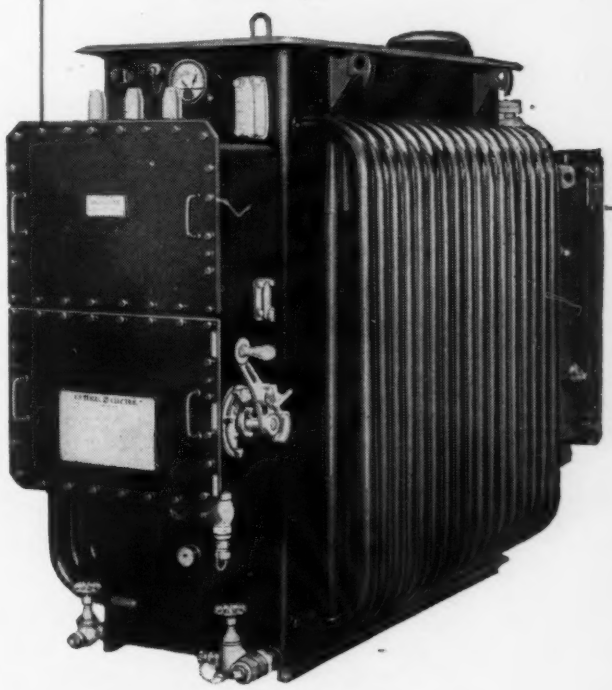
LESS MAINTENANCE G-E standardized network equipments incorporate all maintenance-saving developments which the industry recognizes as desirable—gaskets eliminated by welding cover and switch box to transformer, accessories grouped for maximum convenience, all bushings externally removable without opening the main transformer tank, dust-tight relays which can be easily removed for checking, and then replaced.



With manhole openings at both ends, vault need be only 14′ long, 4½′ wide for 500-kva transformers.



A clear depth of 7′ below roof slab will provide sufficient room for maintenance and inspection.

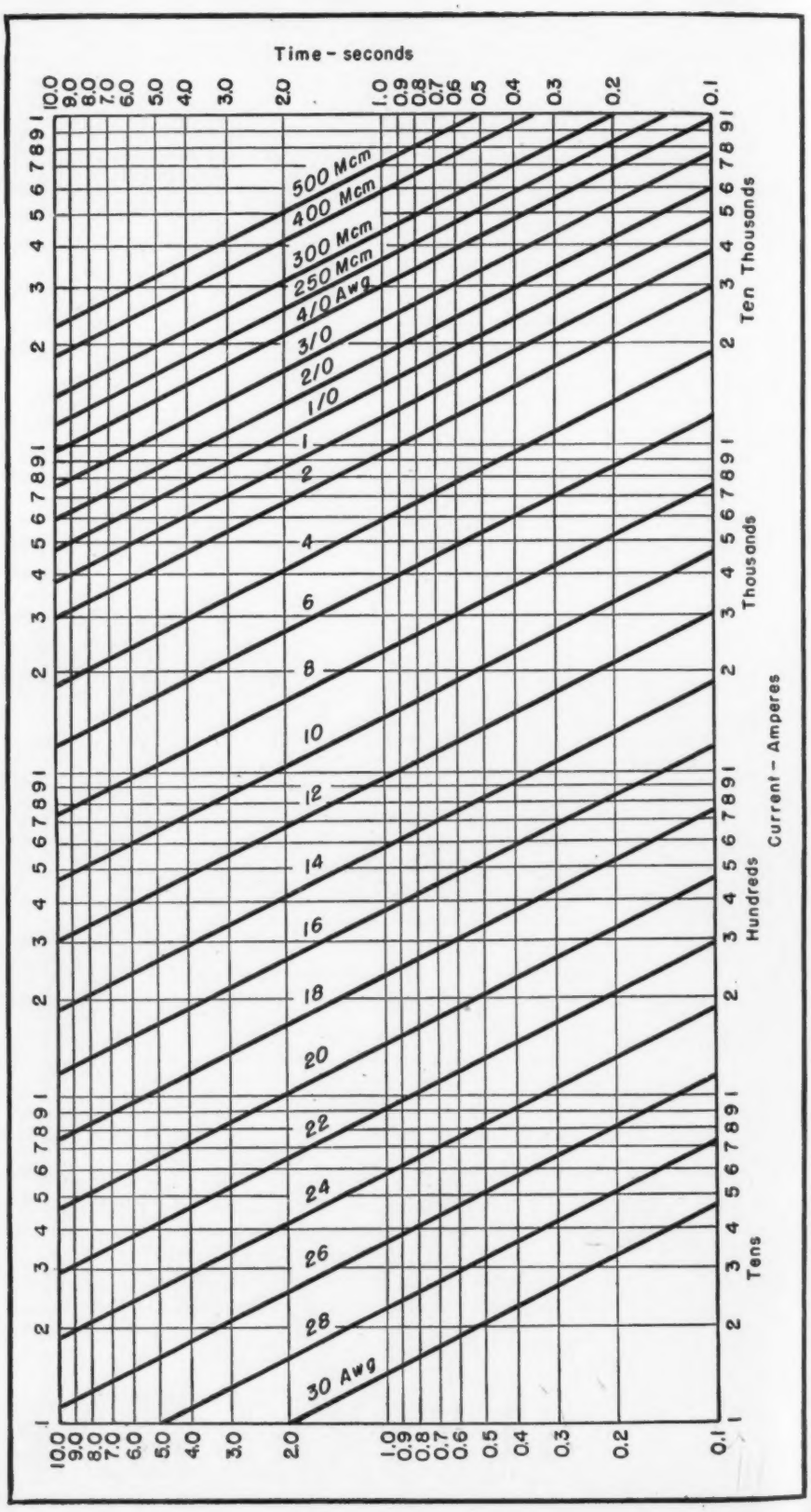


An inquiry to your G-E Representative or a letter to *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*, will bring you information on standardized network equipment—and just what should be specified to secure the savings which this equipment makes possible. Bulletin GEA-5024 describes standardized network transformers; GEA-2017 describes G-E network protectors.

GENERAL ELECTRIC

Fusing Current-Time For Copper Conductors

Chart gives fusing current for conductors in sizes from 30 Awg to 500,000 cir mil from 0.1 to 10 sec.



Graph is based on the following assumptions:

1. Radiation may be neglected due to the short time involved
2. Resistance of 1 cm cube of copper at 0 C is 1.589 microhms
3. Temperature-resistance coefficient of copper at 0 C is 1/234
4. Melting point of copper is 1083 C
5. Ambient temperature is 40 C

Data are an adaptation from advance pages for forthcoming 8th edition of Standard Handbook for Electrical Engineers.

SEE REVERE

FOR CONDENSER TUBES AND PLATES

EXPERIENCE has proved that in a majority of installations Revere Admiralty Metal condenser tubes, inhibited to resist dezincification, will give long, satisfactory and economical service. However, Revere also makes tubes in Cupro-Nickel, Revalon (aluminum brass), Red Brass, Muntz Metal, Arsenical Copper, and Copper, thus enabling you to select the Revere Metal or Alloy best suited to meet your operating conditions.

In addition, Revere manufactures pipe and tube in copper and brass for general piping purposes, and electric welded steel tube.

Revere condenser plates can be had in a number of alloys in squares, rectangles, circles, half-circles, segments, and special patterns, up to 120 inches maximum dimension, finished weight about 11,000 lbs. maximum. These plates are flat, dense, free from blow holes or other imperfections, accurate in gauge, and are easily machinable.

As each condenser, heat exchanger or other piece of equipment using tubes and plates presents an individual combination of conditions, no blanket recommendations are possible. Among the factors to be considered are: chemical and impingement attack, velocities, pressures, temperatures, air entrainment, suspended solids. Should short tube life or other circumstances lead you to question your present practices, the Revere Technical Advisory Service will gladly cooperate with you in making thorough field and laboratory studies, to assist you to determine the most serviceable and economical alloys.

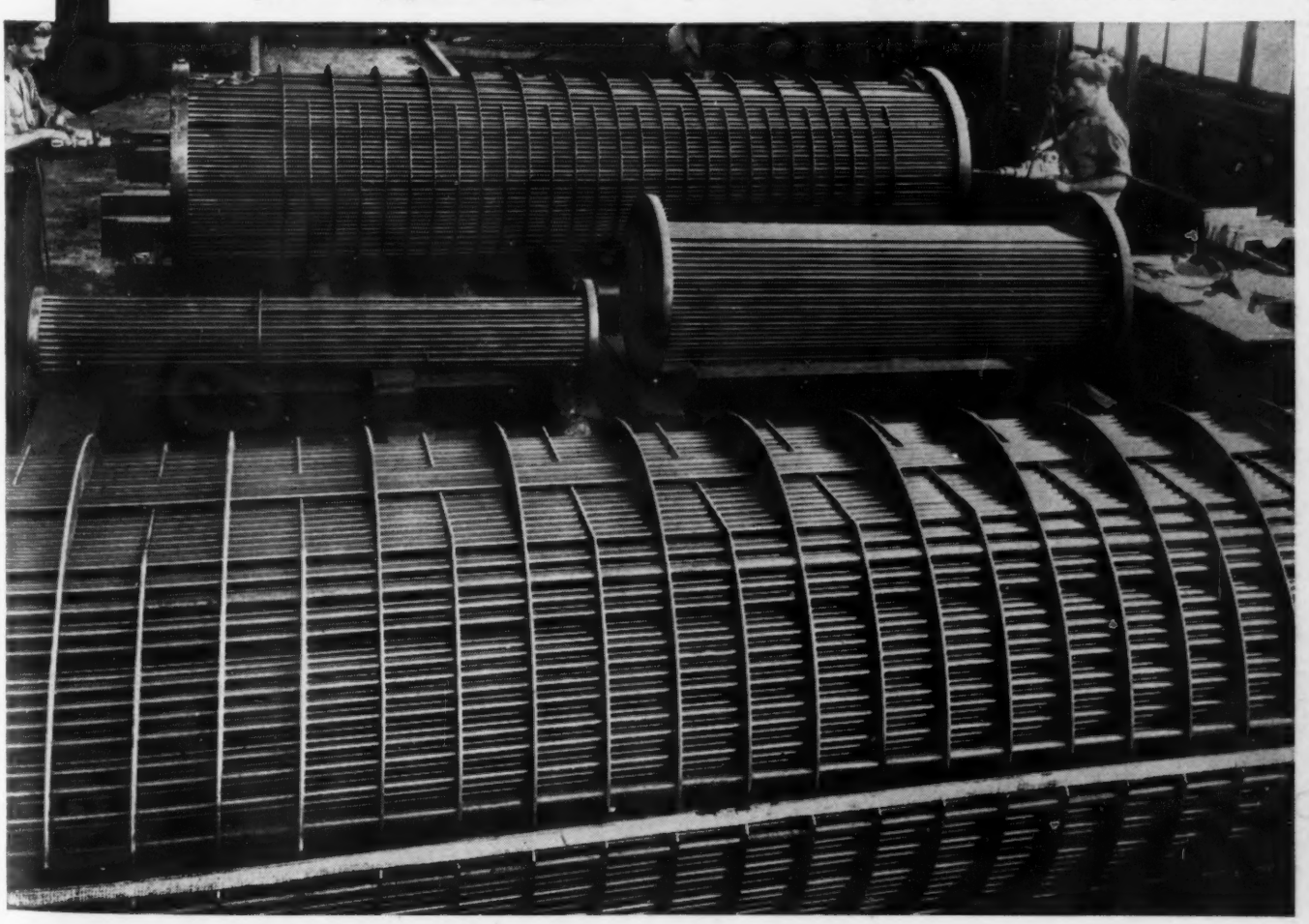
REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

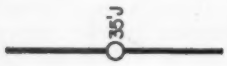
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y. — Sales Offices in Principal Cities, Distributors Everywhere.



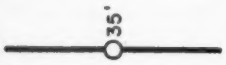
Symbols Developed for Distribution Maps

II—Secondary Circuits

Series of symbols listed here have been standardized by Georgia Power Co for use on both construction prints and distribution maps



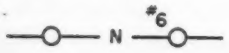
Electric Co pole and height; joint use (Telephone Co unless otherwise indicated).



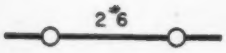
Electric Co wood pole and height. Creosoted pine unless marked "N" for native or "S" for steel. Transmission poles supporting distribution shall be marked "TR".

Foreign Co pole and height; joint use (Telephone Co unless otherwise indicated).

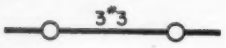
Secondary ground.



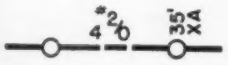
Neutral conductor and size.



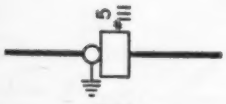
Two-wire conductors and size (show voltage if other than 115-v circuit).



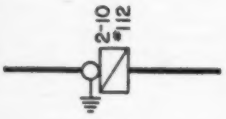
Three-wire conductors and size; on secondary racks. All changes in wire sizes shall be definitely marked.



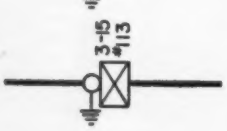
Four-wire conductors and size; on crossarms, three-phase power and lights (show voltages on all circuits other than 115 or 230 v.)



Single transformer; capacity and location number.



Two transformers; capacity and location number.



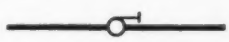
Three transformers; capacity and location and number.

Three transformers; 120/208-v secondary.

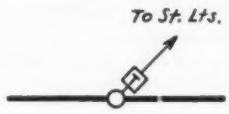
Autotransformer

Two transformers; three phase to two phase or two phase to three phase.

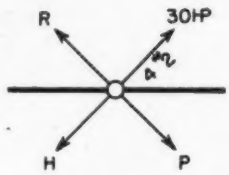
Metering equipment. Always show in circuit metered. Primary meters, here shown on secondary maps for location only, shall be placed out from pole so as not to be confused with secondary meter.



Anchor guy; use figure to indicate more than one guy.



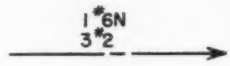
Time switch.



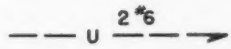
Service drops. R = range; H = water heater; P = water pump.

Two-wire service drop; No. 8 wire unless otherwise noted.

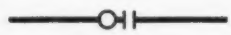
Three-wire service drop; No. 6 wire unless otherwise noted.



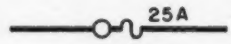
Three-phase service drop; show wire size.



Underground service; show wire size.



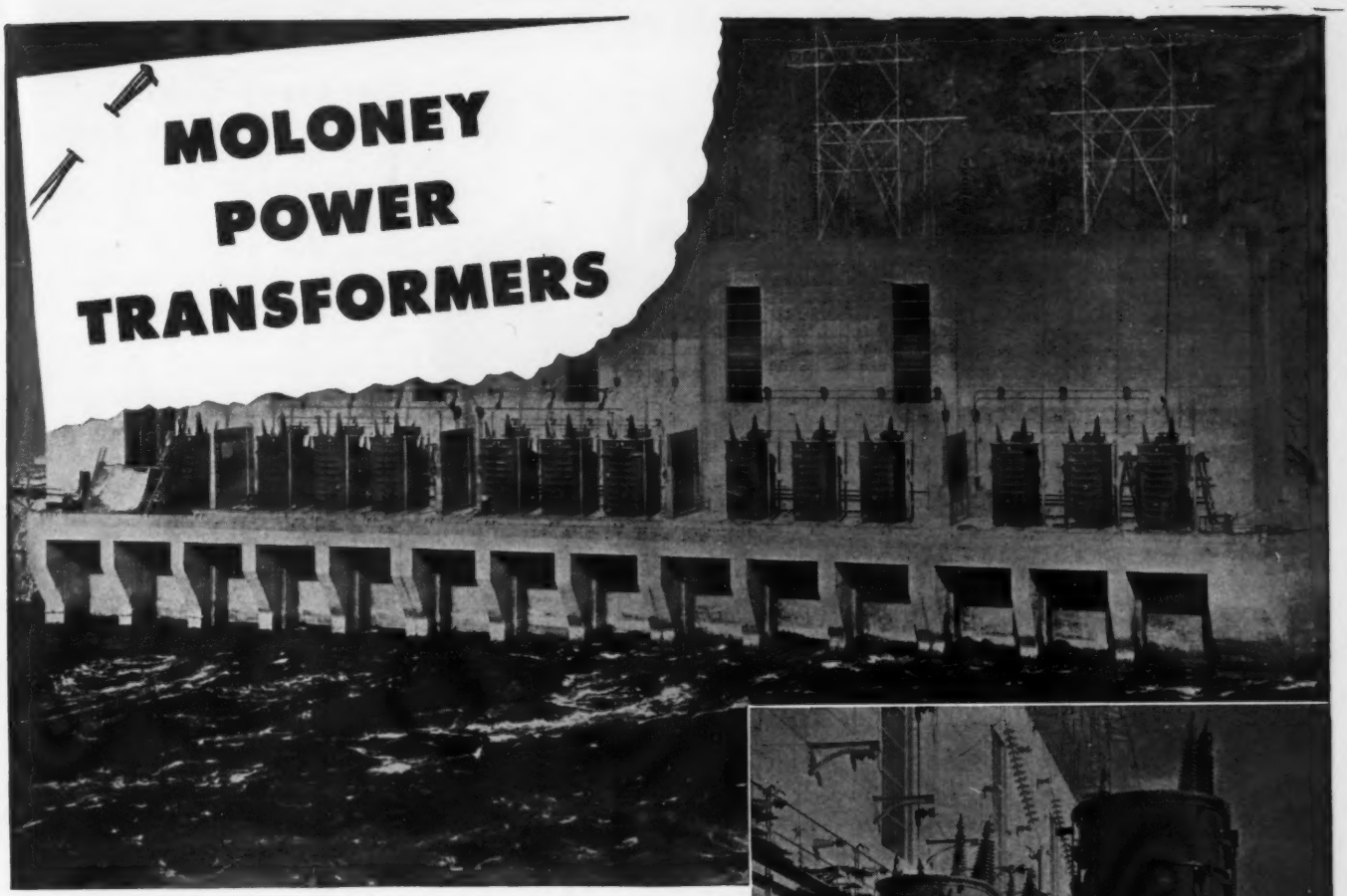
Secondary phase wires open.



Secondary fused cutouts.

Adapted from a paper *Distribution Mapping* by W. F. Poole, Distribution Engineer, Georgia Power Co, Atlanta, Ga, before Southeastern Electric Exchange at Tampa, Florida. This article continues a three-part series which began in ELECTRICAL WORLD, November 20, 1948.

MOLONEY POWER TRANSFORMERS

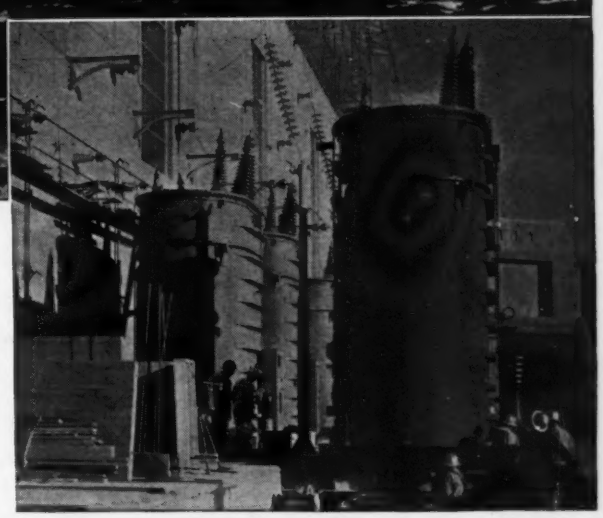


Bureau of Reclamation Photos

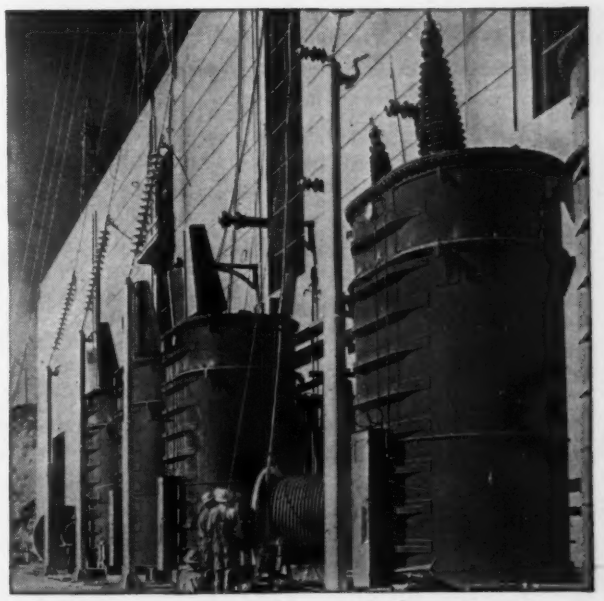
Like thousands of other Moloney Power Transformers, these 10,000 Kva water-cooled units are doing a good job 24 hours a day. Twelve of them are used at this hydro-electric plant to step up generator voltage to suitable transmission voltages. A thirteenth is used as a spare.

Nine of the transformers are rated 6800 to 92955/161000Y volts. The other four are similarly rated but have an additional 39840/69000Y volt winding of 10,000 Kva capacity, permitting a selection or combination of transmission voltages.

These transformers have been providing dependable service since 1943 and, based on past records of numerous other Moloney installations, will continue to do so for many more years. The dependability of well-designed, well-built transformers is yours when you specify Moloney.



Moving transformer into place from transfer truck.

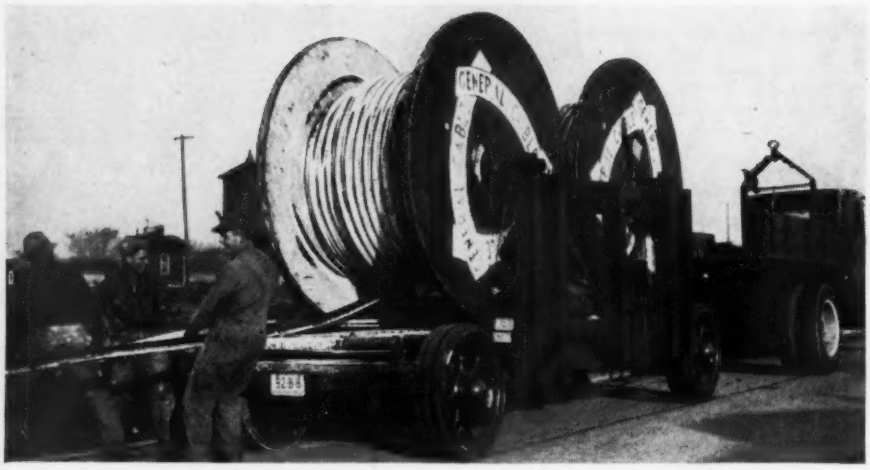


Preparing to connect transformers for operation.

MOLONEY ELECTRIC COMPANY

TRANSFORMERS EXCLUSIVELY SINCE 1896

SAINT LOUIS 20, MISSOURI



TWO CABLES are installed simultaneously from a flat bed trailer, with reel supports improvised for the purpose

Trench-Lay Cable Satisfactory

I. H. HEITKAMP
Underground Engineer
Toledo Edison Company

EXPERIENCE with rather long trench-lay cable runs between substations has been so satisfactory that the company has adopted the practice of burying comparatively short lateral feeder runs leaving unit substations. These 4,160 and 7,200-v feeders are laid directly in the trench and extend to the lateral pole. No ductwork is utilized.

Installation of the buried cable is ideal where the number of cables is small and it is anticipated that no additional feeders will be required in the future. By using screened and tamped earth (clay or loam) around the buried cable, it has been possible to increase the load on the buried cables. The screened and tamped earth dissipates the heat better than sand or screenings and removes the danger of abrasions from sharp stones.

Our experience with buried power cable extends back to 1937, when a 30,000-kva tie was installed between Vulcan and Detroit Avenue Substations. This consisted of two 3-conductor 300-MCM, solid, paper insulated, shielded, lead and jute-covered cables which were buried in 13,513 ft of trench, and operated at 24.75 kv. These were installed along edges of city parks, back of street curbs, in alleys and across open fields. The pair of cables were buried in a trench 3-ft deep and 2-ft wide. The cables were spaced 18 in. apart and imbedded in 3 in. of screened and tamped earth.

A 2 x 8-in. creosoted plank was placed 3 in. above each cable and the line of the trench was marked at intervals with precast concrete slabs, flush with the ground, reading "Buried Power Cable, The Toledo Edison Co" Under streets, the cable is run in iron pipe.

The success of this installation prompted the adding of two more in 1940. One was a 4,268-ft run from Ironville Substation to the city pumping station, and the other, an alternate feeder, a run of 6,243 ft from the Toledo Furnace Substation. Both carry 7,200 v for the 6,000-kva load at the pumping station. In this case, two three-conductor, 250-MCM, solid, paper insulated, belted, lead and jute covered cables were laid in the trench.

Outcome of Experience

Although our experience with buried cable has been limited, it has been so satisfactory that the laying of short lateral feeders from unit substations was a natural outcome. In the eleven years, only two failures have occurred. One of these was caused by a nail in the cable reel.

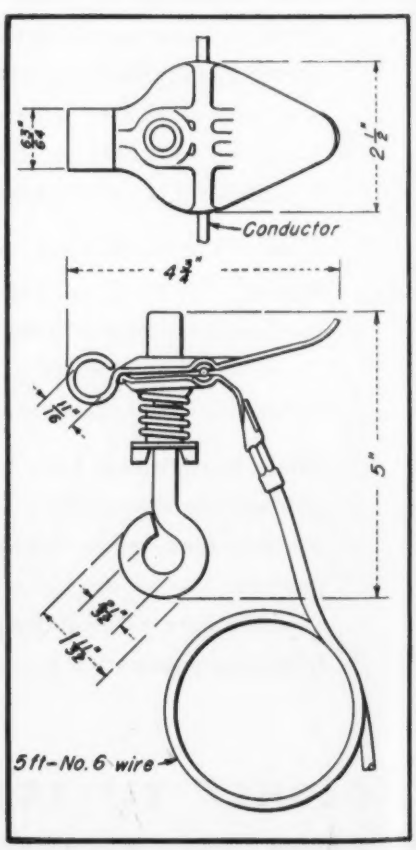
Only one change in the method of installing buried cable is contemplated. This is the substitution of precast concrete slabs for the creosoted plank used to cover the cable.

Line Clamp Resists Excessive Vibration

FOR SERVICE as a tap-off on an energized line, a bell-mouthed bronze clamp that withstands considerable vibration has been developed by Thomas & Betts Co, Elizabeth, N. J. The clamp snaps rapidly into place on the conductor and can be rapidly snapped off, with a hot-line tool. This characteristic fast engagement and disengagement of the clamp prevents excessive arcing.

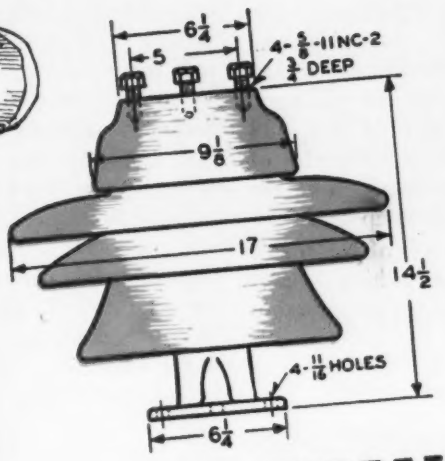
One size can be used with copper wire No. 8 through No. 1/0 and corresponding sizes of Copperweld conductors. The device is locked into position by tightening the eyebolt. Bolt threads are lubricated and protected at the top so that the clamp will not "freeze" on the line. Between the eye-bolt shoulder and the movable or lower lip, a phospor bronze spring is mounted to prevent loosening of the clamp through vibration. The wire groove is rounded and bell-mouthed to prevent damage to the line conductor.

A vibration test was made with the clamp over bare cable (No. 4



CLAMP designed for attaching to energized conductor and furnished with tap lead

This is O-B's No. 31152 Switch and Bus Insulator

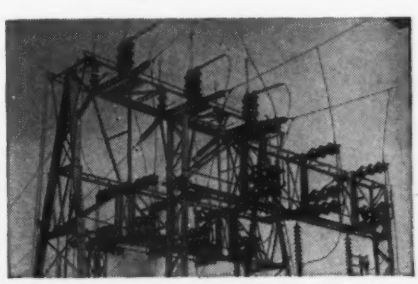


Don't Ignore the *Mechanical* side of a Switch and Bus Insulator

CHECK YOUR STANDARDS

This O-B Number 311 52 switch and bus insulator is a BIL stacking design for 115-kv ratings and above. It may not show on your present purchasing standards. It would pay you to check them now.

Let's take a look at the mechanical side of a switch and bus insulator. It must be *mechanically* accurate to fit switch parts and maintain proper operating alignment, or to match up in stacks, or to take its place in a bus network. It must be *mechanically* strong to resist shocks, twisting strains, and cantilever loads in switch applications. It is bolted to a steel structure whose thermal expansion and contraction may impose unpredictable *mechanical* strains. . . In a switch and bus insulator, porcelain and metal are combined. These two unlike materials react differently to temperature change and, if the insulator is not designed skilfully, internal *mechanical* forces can damage it. All these *mechanical* factors add up to help determine ultimate performance. . . The fact that thousands of O-B switch and bus insulators are serving today, after 30 years or more, is the best reason why your substations should be O-B-insulated.



SPEAKING OF LONG LIFE

Typical of O-B durability, these switches have operated with O-B insulation on this heavy 138-kv station for 28 yrs.

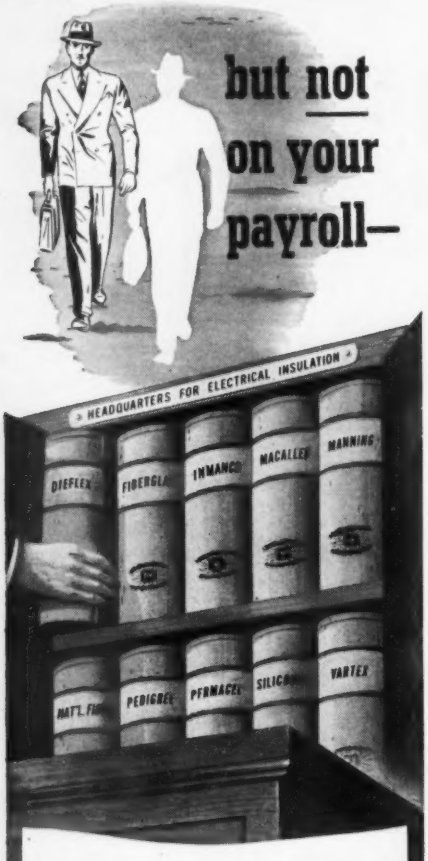
Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

2868-H

THE IMC ENGINEER IS ON YOUR STAFF



The IMC Engineer offers two important services to help you solve electrical assembly problems:

1. A complete line of nationally advertised insulating materials.
2. Expert advice and engineering service on the best aplication of these materials.

Ask your nearby IMC engineer to help you solve your insulation problems. He is trained in the application of electrical insulation, and can usually suggest an answer from his experience and complete line of products.

INSULATION MANUFACTURERS CORPORATION

ELECTRICAL IMC INSULATION

★ CHICAGO 6, 565 West Washington Blvd.
★ CLEVELAND 14, 1231 Superior Ave., N. E.
MILWAUKEE 2, 312 East Wisconsin Ave.
DAYTON 2, 1315 Mutual Home Building
DETROIT 2, 15 Lawrence Avenue

REPRESENTATIVES in MINNEAPOLIS 3, 1208 Harmon Pl., and PEORIA 5, 101 Heinz Court

ACSR 7/1) and attached 18 in. from the center of pin insulator. The cable was vibrated at a frequency of approximately 3,570 cpm. The test was discontinued after 100 million cycles without cable failure.

Heat run tests were made with the clamp attached to No. 6 solid copper and No. 4A Copperweld copper and at loads of 50, 75, 100 and 125 amp, room temperature 70 F. For a load of 125 amp, the temperature rise of the clamp was 53% as much as the cable and 11% for 50-amp load.

Tap conductor is 5 ft of No. 6 soft annealed copper wire which is permanently connected by a compression fitting to the clamp.

Rural Distribution Voltages*

WADE M. EDMUNDS
and
GLENN B. ROLSON
Rural Electrification Administration
Washington, D. C.

VOLTAGES on rural distribution systems covered a wide range when REA was established in May 1935, and included some of the multi-grounded wye systems in use today. Single-bushing 6,900, 7,200, and 7,620-v transformers were used.

In December 1936, after studying these voltages, REA suggested specifications for 12,000/6,900-v wye multi-grounded neutral distribution circuits. This was based largely upon TVA practice and because transformers were available. These suggestions soon were changed to the present 12,470/7,200-v wye multi-grounded neutral specifications.

The earlier REA-financed systems had consumptions averaging about 50 kwhr per month per consumer. A few years ago, most lines were designed on the basis of approximately 100 kwhr per month per consumer. Now, 300 and 400 kwhr per month per consumer are not unusual and the end is not yet in sight.

It appears that some departure from the present standard distribution voltage is required. As early as 1937 the REA considered the possibility of using 22,300/13,200 v as another multigrounded wye voltage standard.

The load capacity of a distribution system varies as the square of the system voltage. A 23.9/13.8-kv wye-connected, multigrounded system would have 3.67 times the capacity of a 12.47/7.2-kv system using conductors of the same size. A uniformly loaded line at 23.9/13.8 kv may be extended 90% further and serve 3.67 times the area of a uniformly loaded line at 12.47/7.2 kv with the same size conductors. This takes into account the loads on the additional 90% of line.

About 1942 a cooperative in Minnesota purchased approximately 50 miles of 23.9/13.8-kv wye-connected, multigrounded transmission line with some 13.8-kv, 15-kv insulation class transformers installed along the line. Most of these transformers had been installed in 1916. After the acquisition of this line, the cooperative began buying transformers to be used on extensions to serve farmers, and in 1944 there were some 150 or 160 13.8-kv, 15-kv insulation class transformers (without lightning arresters) connected on this line. The manager stated in 1944 that during the two years the cooperative operated the line, not a single transformer had been lost due to lightning and that the operating experience with the transformers had been excellent. An REA field construction engineer reported on this line in April 1947 and from what he could learn, no more 13.8-kv transformer failures occur than with the 7.2-kv transformers on other parts of the cooperative's system. Some of the 23.9/13.8-kv line has been absorbed into the 12.47/7.2-kv portion of the cooperative's system so that there are now 80 miles of 23.9/13.8-kv line with 70 transformers.

Estimated costs of two proposed projects in Colorado are:

	Project A	Project B
Primary Miles	387	208
Consumers	434	238
Cost using 12.47/7.2 kv.	$702,672	.....
Cost with transmission line and substations added	$559,756	$625,000
*Cost with 23.9/13.8-kv distribution	$475,565	$415,000
Percent saving 23.9/13.8 kv over 12.47/7.2 kv plus transmission	15%	34%

* 15-kv insulation class transformers with the same lightning arresters as if the transformers were connected in delta.

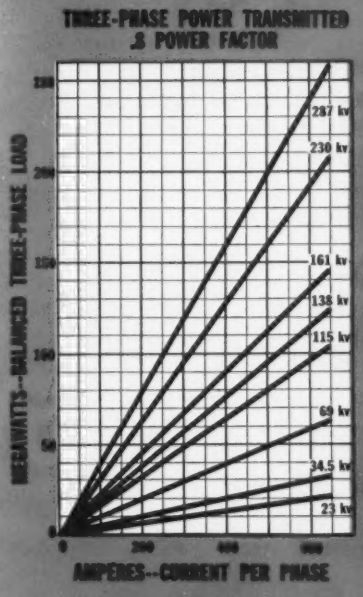
Increasing the distribution voltage to 23.9/13.8 kv does not materially affect conductor separation, although it would decrease the maximum allowable span length to a small extent. Apparently the NESC permits

* From a paper presented at the present AIEE Middle Eastern District Meeting.

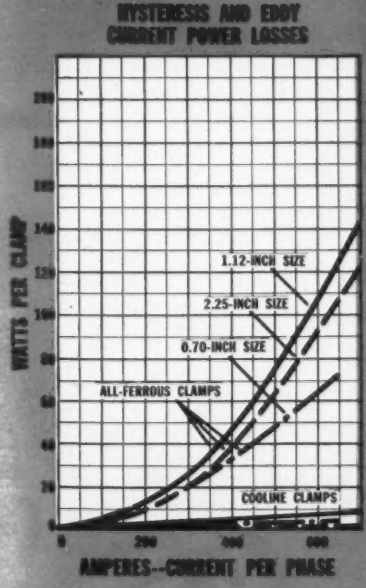
FIGURE IT YOUR OWN WAY

...Here's a Quick Route to a Simple Answer on O-B COOLINE Clamps

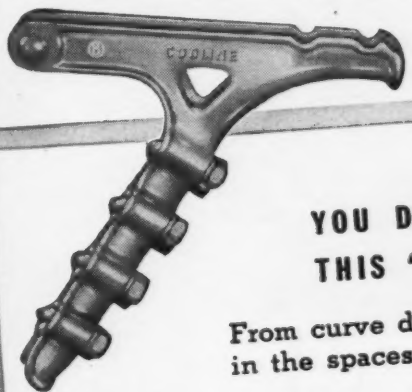
Take one of your typical lines now in operation, and put down its data on this "form". See for yourself what O-B's new Cooline hardware has to offer. You can prove by a process of simple arithmetic that this hardware brings an attractive savings to the operation of the average line above 69 kv.... Equally desirable, today, is the fact that O-B Cooline hardware is in good supply.... We will gladly provide more detail if your figures reveal the need for further investigation. Otherwise, place your order now for O-B Cooline hardware.



These facts must be worked in terms of current per phase. Find your transmission voltage at right and follow line down to where it intersects the horizontal ordinate corresponding to your balanced three-phase load in megawatts (1000 kw). From this point drop to bottom to find amperes per phase.



Select your amperes per phase along bottom line and read up to the curve for all-ferrous clamps corresponding closest to your own clamp size. Follow this point to the left margin where watts-loss per clamp is indicated. This figure is the basis for cost calculations and appears under (1) in the questions.



YOU DON'T HAVE TO SEND THIS "FORM" TO ANYBODY

From curve data, you can insert values in the spaces provided.

(1) Watt loss *each* of present clamps - - - - - - _____

(2) Multiply (1) by number of clamps on line - - _____

(3) Divide (2) by 1000 for total loss in kw. - - _____

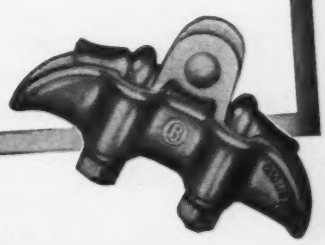
(4) Convert (3) to kwhr based on your load factor - _____

(5) Multiply (4) by your generating cost per 1 kwhr _____
The last figure is a *repetitive yearly saving.*

(6) Multiply (3) by your installed cost of 1 kw generating capacity at the station - - - _____

This figure represents the capital investment expended to keep your present clamps hot. Cooline hardware will put this capital to work earning a normal profit.

NOTE: For a rough estimate, the added cost of Cooline hardware over ferrous equivalents runs from par to not over $1.30 per clamp. The average is about one dollar. You pay this *only once,* while the above figures compound themselves over the life of the line.



Ohio Brass

MANSFIELD (B) OHIO, U. S. A.

CANADIAN OHIO BRASS CO., LTD. NIAGARA FALLS, ONTARIO

no more worries for me

...now that

KOPPERS CREOSOTE

is plentiful again!

IF you need creosote for pressure-treating wood, just send an SOS to Koppers, and we'll ship your requirements. And you'll look just as happy as the man above, because you'll get the same high-quality Koppers Creosote you've always known.

When you order Koppers Creosote (or Koppers Creosote-Coal Tar Solutions), it's important to remember that you're getting products that have decades of dependable performance behind them . . . that have established enviable records as wood preservatives everywhere.

Send in your order now. And if you want to *play safe*, ask about Koppers yearly contracts that take care of your future needs.

KOPPERS

All Standard Specifications
For All Types of Wood Preservation

KOPPERS COMPANY, INC.
Pittsburgh 19, Pa.

the same ground clearance for single-phase sections of 23.9/13.8-kv systems as on present systems; however, an additional 2 ft ground clearance is required on multiphase sections of 23.9/13.8-kv systems.

No REA-financed systems have as yet been completed using 23.9/13.8-kv distribution. The transformer manufacturers do not recommend nor guarantee their 15-kv insulation class transformers for this service. Their objections are based mainly on these two points:

1. On a 13.8-kv, 15-kv insulation class transformer, the insulation between the winding and the case was designed for the electrostatic voltage of 7,968 v. The phase voltage of 13,800 would only occur between the winding and case under faulted conditions. When this transformer is connected between a phase wire and ground on a 23.9/13.8-kv wye-connected system, the voltage between the winding and case would always be 13.8 kv.

2. On a 13.8-kv, 15-kv insulation class transformer connected between a phase wire and ground on a 23.9/13.8-kv wye-connected system, a fault to ground on one phase would cause an excessive voltage rise on the other phases which would damage the transformers.

Weighing the need in some areas for a considerably higher distribution voltage that would be economical, against the possible hazards of equipment failure, it has been decided that some construction at a distribution voltage of 23.9/13.8 kv is warranted at this time.

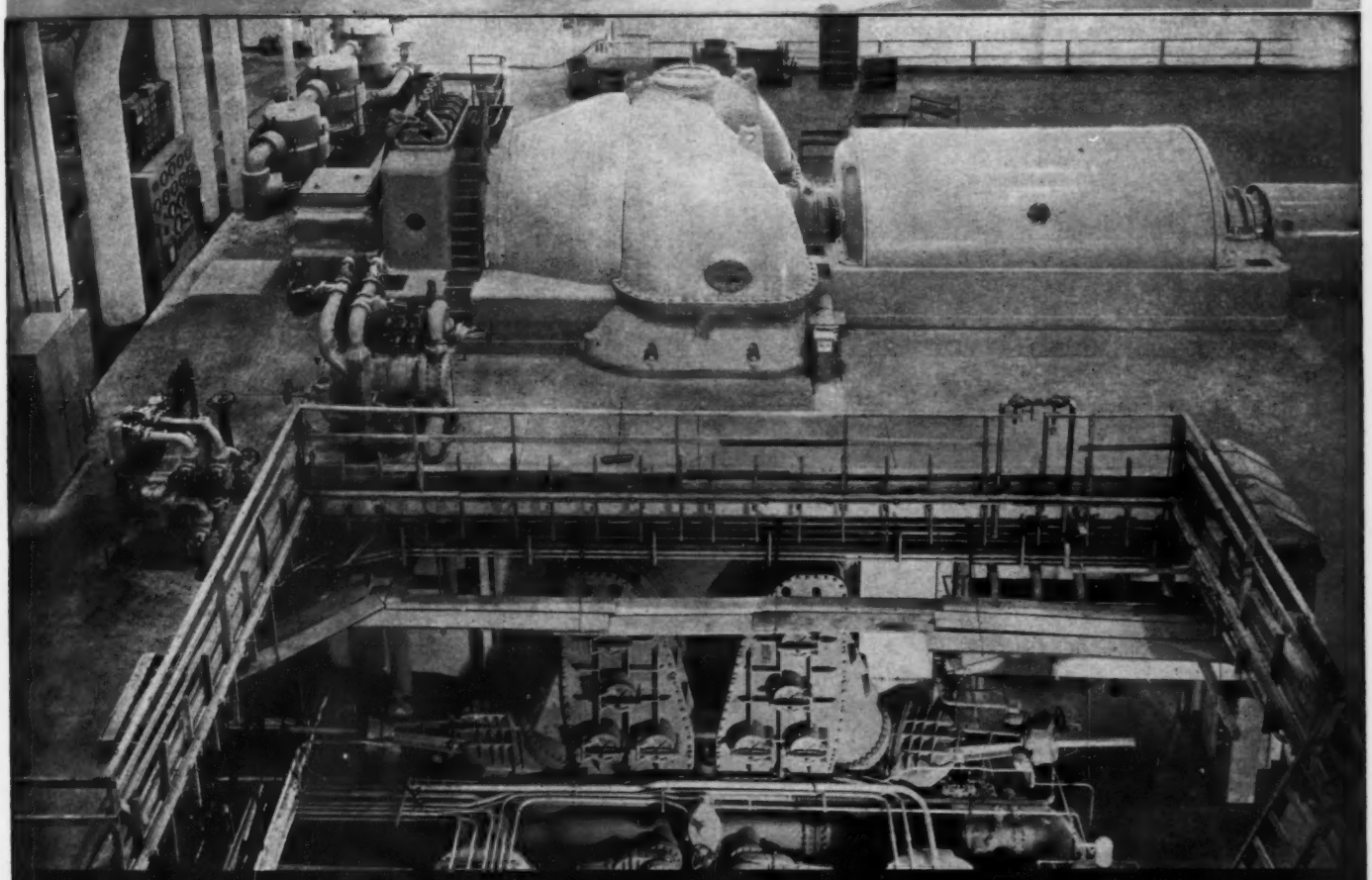
Two Projects Approved

The Arizona project will consist of 284 miles of distribution line to serve 365 consumers. The first section, 125 miles to serve 174 consumers, is under construction. The area farthest from the source of power is at a distance of 70 miles. The distribution transformers to be used on this system are 13.8-kv transformers of the 15-kv insulation class.

The project in New Mexico will consist of 166 miles of distribution line to serve 248 consumers. The farthest extremity of the project from the substation is 76 miles. Consideration is being given to a new distribution transformer design which will have insulation somewhat higher than the 15-kv class.

in stride...

FABRICATION



The divided water box condenser shown above serves a 60,000 kw turbine unit at the Kern Plant. The condenser has an effective length of 26 ft., and contains 35,000 sq. ft. of surface. The cross flow design, providing a central steam lane between the two banks, permits the best possible supply of steam to the hotwell for deaeration and reheat of the condensate. Circulating pumps receive water from the forced draft cooling towers and deliver it to the condenser and back to the cooling tower for re-cooling. Condenser auxiliaries include a 2,000 gallon storage hotwell, twin-element, two-stage steam jet air ejectors, hogging and priming jets, three-stage centrifugal hotwell pumps, and the circulating pumps mentioned above.

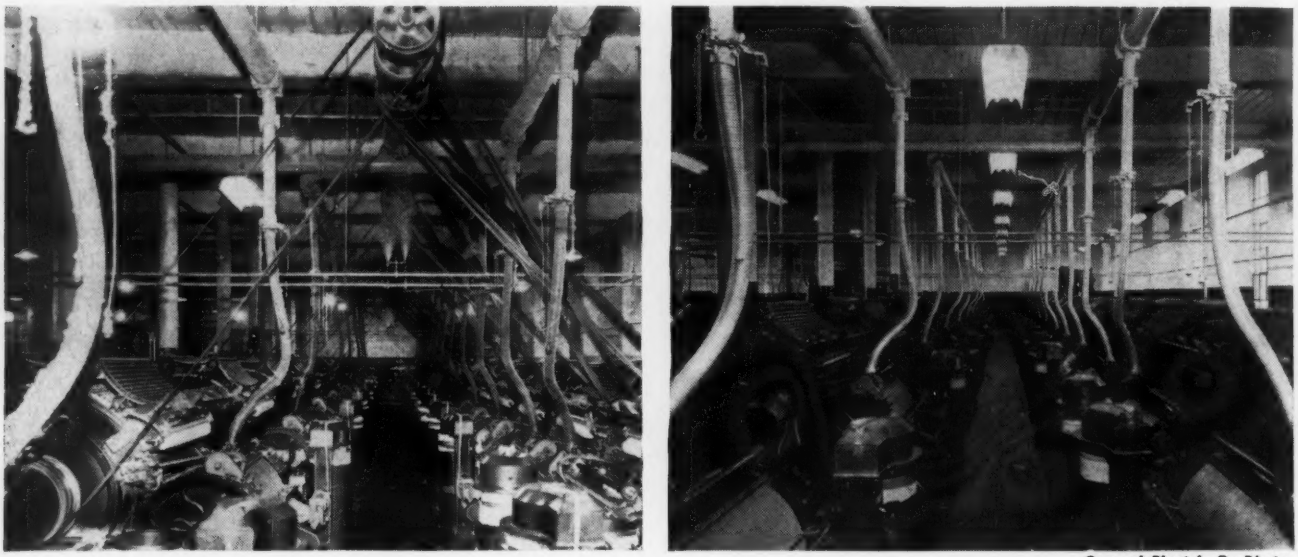
organization which knows how to handle a job from the proposal stage to the finished construction. The fact that Foster Wheeler is geared to keep many projects of equal size and larger going at the same time indicates the scope of FW's engineering and manufacturing capabilities.

SERVICE

165 Broadway, New York 6, N.Y.

FOSTER FW WHEELER

LOAD BUILDING



General Electric Co Photos

CARD ROOM before and after installation of individual drives. Group drive (left) with line shaft and belts; individual drive (right) using 1½-hp totally enclosed type motors. Greater flexibility and improved working conditions have resulted from this changeover

Individual Motor Drive Reduces Production Cost

J. C. EDWARDS
Superintendent
Exposition Cotton Mills
Atlanta, Ga.

CONVERSION during 1947 of 249 flat-top card machines from group drive to individual motor drive has resulted in elimination of shaft maintenance, belt replacements, and expensive total shutdowns because of motor failures on mainline shafts. Most of the motors installed are 1½-hp totally enclosed textile mill types.

The individual motor drives eliminated: (1) variation in speed of the cards; (2) product waste caused by static and dirt from belts; and (3) a serious hazard to personnel.

Belt-drives Replaced

Previously, the card machines were group-driven by one 20-hp, one 25-hp, one 40-hp, one 50-hp, and three 75-hp induction motors. Each machine required 30 ft of three-in., light, double-lap belt. Line-shaft trouble included hot bearings and the disalignment of shafts. In addition, line shafts and loose pulleys had to be oiled once a week. It is estimated that the individual drives will pay for themselves in 10 to 12 years through savings in shaft maintenance and belt replacements alone.

Installation of individual drives has improved operating and working conditions. Greater flexibility also can be exercised in arranging the card machines, thereby facilitating the servicing of the cans and picker laps.

Apartment House Wiring Modernized at Low Cost

WARREN APARTMENTS, built in Newton, Mass., about fifty years ago, have been rewired to the great advantage of owner and tenants. Some 24 apartments were involved in the modernization program.

The Longacre Trust, owners, Boston Edison Co, and the contractor discussed the problem of modernization and its financing. This was done through a local bank on the basis of amortizing the new $6,500 wiring layout over a 5-year period, at an average monthly cost per apartment of only $5. It was found that $1,500 for electric ranges could be provided over such a period at an average monthly cost per apartment of $1.10. This total of $6.60 could be covered by a modest increase in rentals.

Haphazard System

The original wiring was open, with meters indiscriminately placed, frequently in closets relatively inaccessible to meter readers. Flexible cord extensions were common, and many kitchens had no appliance outlets. Refrigerators were connected to back hall lighting circuits. The original service entrance was 100 amps.

When the owners found that the wiring could be modernized without taking money from their own pockets,

"We never know when it's raining"...

A battery of 3-lamp Day-Line fixtures individually hung from Hydee Hangers provides excellent visibility for typesetting in the composing room of Warwick Typographers, 920 Washington Ave., St. Louis, Mo.

says this delighted user of DAY-BRITE Lighting Fixtures

We're quoting verbatim from this firm's own house organ:

"There are no gloomy, dreary days for us folks here at Warwick. Our new home is equipped with an ultra-modern type of "Day-Brite" lighting.

"We've noticed that this plenty-bright but scientifically diffused, shadowless lighting has helped our morale. There are no personal-efficiency "peaks" and "valleys" due to the weather... but a steady, smooth output, day after day."

Day-Brite Heavy-duty industrial fluorescents are optically-engineered for glarefree, restful vision... lasting efficiency... easy, low-cost maintenance.

The **DAY-LINE** heavy-duty industrial fluorescent fixtures are designed for two and three 40-watt and two 85-watt lamps. Sturdy, porcelain enameled reflectors... truss-type channel construction... unit or continuous installations. The 40-watt fixtures are equipped with the new TURRET sockets and open or closed end reflectors.

U. S. Patent Nos. 2317434, D-135375 and D-133458.

May we send you bulletin 3-A-2 with complete details?

Day-Brite Lighting, Inc., 5425 Bulwer Avenue, St. Louis 7, Mo.
Nationally distributed through leading electrical supply houses.

In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

009

IT'S EASY TO SEE WHEN IT'S

DAY-BRITE *Lighting*

the go-ahead signal was given. A 400-amp service entrance was provided; all meters were concentrated on a single board in a locked room; flexible armored cable was installed throughout; outlets were provided on a minimum spacing of 6 ft in each apartment; and sub-mains were run large enough to provide an electric range outlet in all apartments, which are of the 3-room unit type.

Other Improvements

House telephone and doorbell batteries were replaced by a rectifier wired to the meter board on the general house meter. Front halls are lighted by 15-w fluorescent fixtures providing 24-hr service. Back hall lighting can now be controlled by means of a time switch.

CENTRALIZED meter board replaced scattered installations and insured regular meter readings

Electric Kitchen Feeds Motor Factory Workers

WHEN the Reliance Electric & Engineering Co built its new 125,000 sq ft motor factory at Ashtabula, Ohio, the question of in-plant feeding facilities received careful study. The result is an all-electric cafeteria which has been designed to do a specific type of in-plant feeding job at low cost in a relatively short time.

Normal kitchen operation provides for 450 servings per meal, but on occasion, by cooking ahead, the kitchen can provide 2,000 meals.

Electric equipment in the kitchen comprises: a deep fat frier, range, vegetable peeler, two refrigerators and dish washer, as well as a walk-in cooler, steam table, salad tray, coffee urn and combination mixer and grinder. In addition the plant proper has an electric coffee dispensing machine and plans call for installation of an electric Coca Cola dispenser.

ALL ELECTRIC KITCHEN is feature of in-plant feeding service at new Ashtabula, Ohio plant of Reliance Electric & Engineering Co

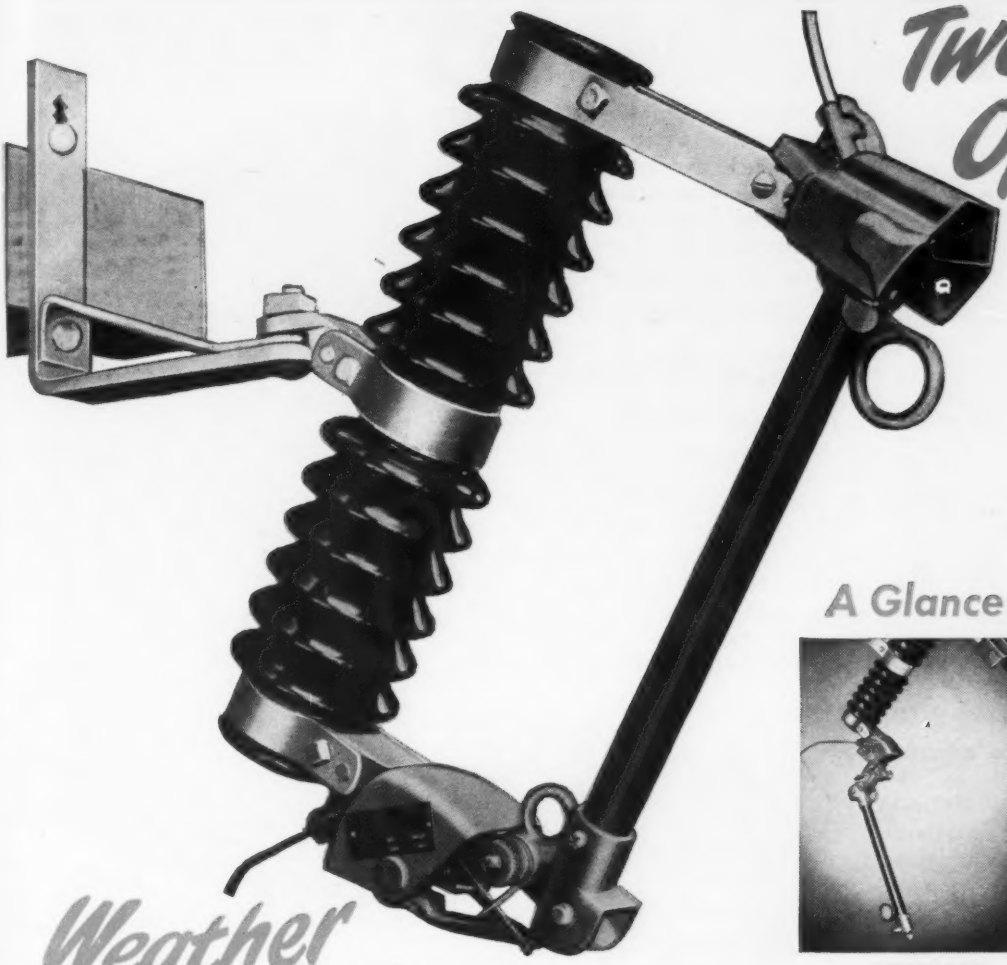
While there are no restaurants in the immediate vicinity of the new plant, the business district and residential areas of Ashtabula are only a few minutes drive for those employees desiring to eat elsewhere. In the light of this anticipated competition the problem of in-plant feeding boiled down to providing restaurant facilities with sufficient flexibility to supply a sandwich, a snack or a complete dinner, but for considerably less than the 500 people who would be employed in the plant.

The cafeteria has a dining room, 25 ft wide and 48 ft long, seating 104 at a time. Its capacity has been purposely limited to this figure, because it represents the number of people who can be served within the 30-min lunchtime allotted per shift. The serving room is 15 ft wide and 21½ ft long; the kitchen is 21½ ft by 24 ft.

The entire feeding job is accomplished in 1 hr and 15 min, using staggered departmental schedules.

CHANCE DROP OUT Fuse Cutout

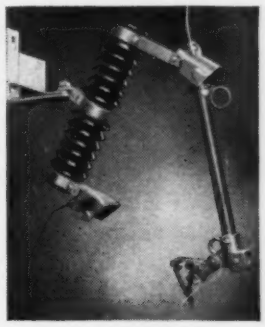
Two-Way Operation



Weather Protected

A Glance tells the Story!

OPERATED MANUALLY



BLOWN BY FAULT

The Chance Type KM Open Dropout Fuse Cutout gives you two outstanding advantages—plus many other features that contribute to more dependable service from electrical distribution systems.

POSITIVE INDICATION . . . A glance shows whether the cutout has been opened as a disconnect or blown. If the fuse tube is hanging from the lower contact housing, it has been opened manually. If the fuse tube is hanging from the upper housing of the cutout, the fuse link has been blown. *Only Chance Dropout Cutouts have this distinctive feature.*

DEPENDABLE OPERATION IN ALL KINDS OF WEATHER. All working parts, at both top and bottom of the cutout assembly, are shielded from ice accumulations. When the fuse link blows, the lower end of the fuse tube swings away from the lower contact, leaving the fuse tube suspended by its closed end. This prevents moisture from entering the fuse tube.

OTHER IMPORTANT FEATURES. When the fuse tube is moved into the closed position, fuse link is not subjected to shock or additional tension causing premature failure. Fuse tube is not subjected to compression stresses or warping when in the closed position.

Pressure contact springs are protected by over-travel stops and wipe contacts clean when fuse tube is installed.

When the fuse link melts, the fuse link leader is quickly drawn out of the tube by an ejector arm which does not lose contact with the clip until it has completed its operation. This operation is delayed during short circuit, reducing the possibility of contact pitting.

Fuse tube may be provided with an attachment which will prevent the fuse leader being thrown from the cutout during a short circuit operation.

Write for full information on these newly developed cutouts.

A·B·CHANCE CO·

210 N. ALLEN STREET CENTRALIA, MISSOURI · 615 TENNESSEE STREET SAN FRANCISCO 7, CALIFORNIA

ABC INDUSTRIES

NEW EQUIPMENT

Ground Rod

A COPPER clad ground rod recently developed is now in production by Jasper Blackburn Products Corp., First and Clinton St, St. Louis 6, Mo. A feature of the rod is its being completely covered, including point and driving end, with a heavy coating of pure copper molecularly bonded to the steel core.

The rod is finished with a cold rolling process to produce a hard scar-resistant surface. The core is said to have a high carbon content, is strong and stiff, and is less apt to bend when driven in a rocky soil. The rod is reported to meet UL specifications and to be approved by REA. It is ½-in. and ⅝-in. dia. in 8- and 10-ft lengths, and ¾-in. dia in 10-ft lengths.

•

Fluorescent Lamp

A NEW 25-w, 33-in, 1½-in. dia, krypton-filled fluorescent lamp for home, store, office, and industrial use has been developed at the Westinghouse Lamp Division, Bloomfield, N. J.

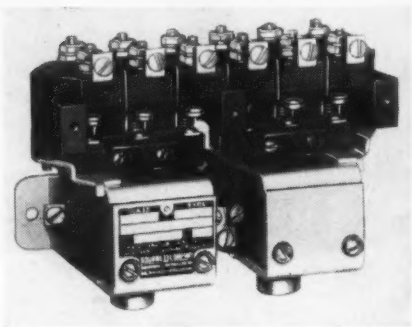
The new lamp is reported to produce more than five times as much light as an incandescent light bulb of equal wattage, produces 50% more light than a 20-w fluorescent lamp with only 25% more electricity, and operates on both a-c and d-c circuits. Its increased efficiency is due to the use of the rare krypton gas (used in place of argon gas) which enables it to start on regular light circuits using standard 20-w starters and low-cost auxiliaries. A choke is required to check the flow of current after start-up. The lamp will be available in five shades of white, including the new warm-white.

•

Reversing Contactor

AN INTERMITTANT DUTY reversing contactor is now made by Industrial Controller Division of Square D Co, 4041 N. Richards St, Milwaukee 12, Wis.

This unit, designed to control small a-c or d-c motors, has double magnet frames and contact blocks with two 3-pole armature assemblies mounted on one base and mechanically interlocked. Double break, silver-to-silver removable



contacts eliminate flexible leads. Normally open electrical interlocks may be provided for three-wire control. Yokes and contact blocks are made of melamine.

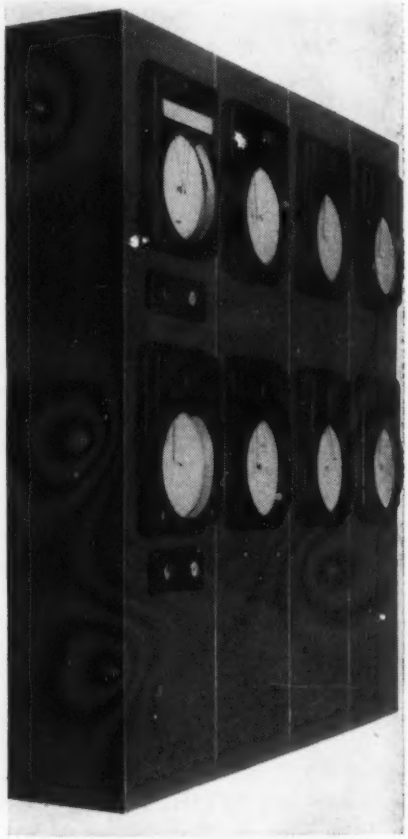
The contactor is said to be suitable for use with a-c polyphase motors rated up to 1 hp and a-c single phase or d-c motors up to ¾ hp.

•

Instrument Cubicles

DESIGNED to contain various types of control, recording and indicating instruments, cubicles of 10-gage steel are made by K & H Industrial Products, Inc, 459 Morgan Ave, Akron 11, Ohio. All models have access door in rear.

Any number of individual Type No. 1 units may be bolted together, interchanged or removed to meet operating conditions. Type No. 2 contains a specified number of cubicles, welded into one



unit, with divided front simulating individual sections. Cubicles may be fabricated with vapor-sealed doors and gas-tight seams, according to the producer.

Units are available in widths of 18, 24, 30 and 36 in.; depths of 12, 15, 18 and 21 in.; and heights of 72, 78, 84 and 96 in.

•

Turn Ratio Test Set

A PORTABLE, direct-reading instrument for measuring turn ratio in transformers is being offered by James G. Biddle Co, 1316 Arch St, Philadelphia 7, Pa. Weighing about 31 lb, the set is designed for use on all types and sizes of power, distribution and autotransformers in common use. Such measurements are helpful in analyzing transformer troubles, identifying tap connections, and giving an indication of polarity. The transformer turn ratio test set consists of a multi-ratio reference transformer which is excited—by means of a small hand generator—in parallel with the transformer under

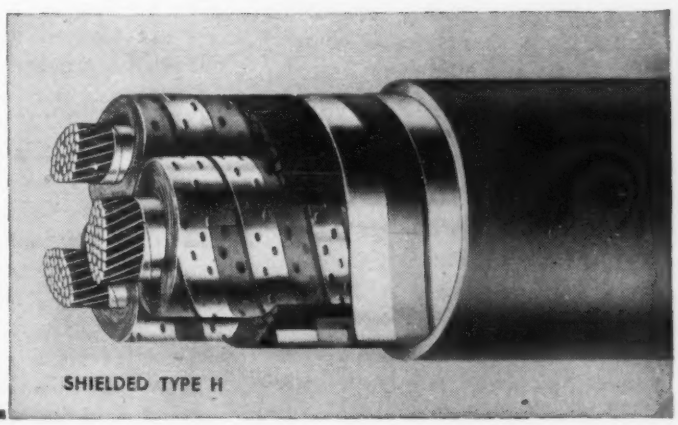
YOUR TROUBLES

GET RID OF OVERHEAD LINES and you get rid of exposure to storms and weather, costly maintenance and unsightliness. With Roebling Paper Insulated Lead Encased Cables your transmission, distribution and service circuits go underground . . . give you dependable, uninterrupted service at lowest obtainable cost.

Roebling Shielded Type H is being widely adopted for 3-phase grounded neutral circuits from 13 to 33 kv. This solid type cable is available both single and multiple conductor construction, in regular and Compack strand (round or sector). Conductors, shielded with metallized paper, are then individually insulated, protected with a perforated copper shielding tape, and the whole assembly served with a bronze binder tape. The finest materials plus Roebling engineering and production techniques give Shielded Type H characteristics of high importance in the utility field.

For a standard power cable or one manufactured for individual requirements, specify Roebling . . . your assurance of dependability and long-term low cost. A Roebling Field Man will be glad to help you select the *right* cable for specific service. Call him at our nearest branch office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities



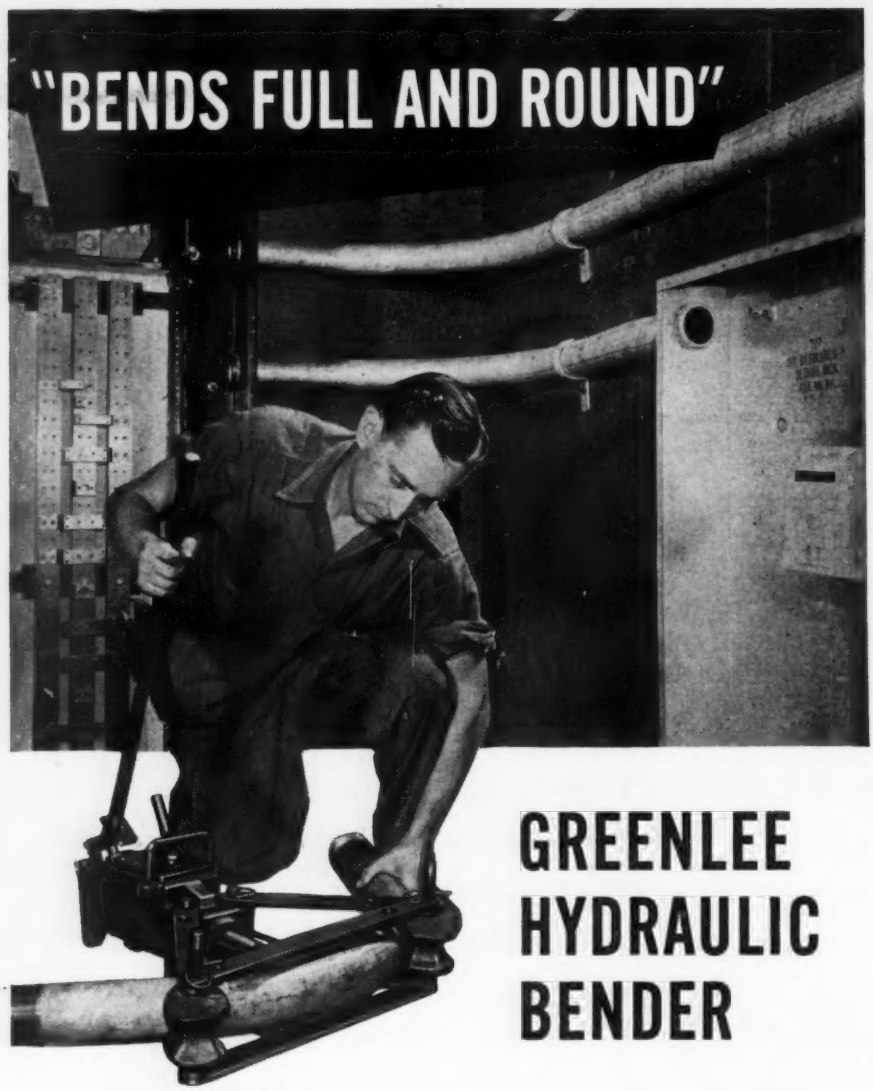
SHIELDED TYPE H

★ WIRE ROPE AND STRAND ★ FITTINGS ★ SLINGS ★ SUSPENSION BRIDGES AND CABLES ★ AIRCORD, AIRCORD TERMINALS AND AIR CONTROLS ★ AERIAL WIRE ROPE SYSTEMS ★ ELECTRICAL WIRE AND CABLE ★ SKI LIFTS ★ HARD, ANNEALED OR TEMPERED HIGH AND LOW CARBON FINE AND SPECIALTY WIRE, FLAT WIRE, COLD ROLLED STRIP AND COLD ROLLED SPRING STEEL ★ SCREEN, HARDWARE AND INDUSTRIAL WIRE CLOTH ★ LAWN MOWERS

ROEBLING

A CENTURY OF CONFIDENCE

JAR ROEBLING



GREENLEE HYDRAULIC BENDER

Yes, on your conduit installations you, too, will find that the GREENLEE "bends full and round, with no flatness or uneven spots on the elbow or curve," just as reported by Papenfuss Electric Co., LaCrosse, Wisconsin.

"And," continues this company's statement about their GREENLEE shown above, "It has been in service nearly 11 years. On the very first job it repaid its cost and has since paid for itself many times over! Its adaptability to the different conduit sizes makes bending a simple operation and brings about substantial labor and money savings."

Investigate the GREENLEE today. See how you, too, can make big savings . . . do the job faster, better.

The GREENLEE Hydraulic Bender is one-man-operated. Makes precise, neat bends in just a few minutes—in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. It's compact, portable, easy to set up and operate.

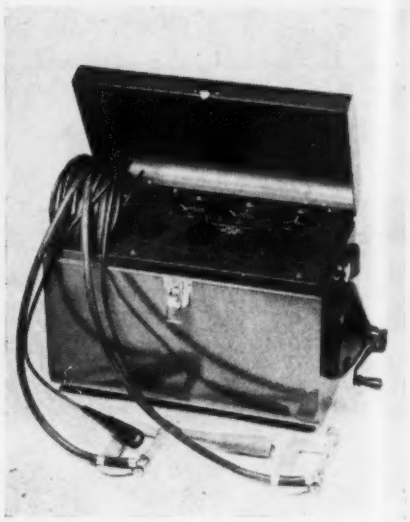
Get all the facts on this timesaving equipment, write for your copy of new free Bender Booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1812 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN

GREENLEE

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK

Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers



test. By means of four dial switches and a null balance indicator, the reference transformer is adjusted in ratio to equal that of the transformer under test. The ratio is then read directly from the dial switch indexes. Ratios up to 130 can be measured with an accuracy to within one part in 1000, it is reported. The set operates without burden, at low-voltage excitation and by null balance, and therefore gives a precise measurement of no-load voltage ratio.

•

Lamp Ballasts

FLUORESCENT lamp ballasts with screw-in clips have been announced by the Specialty Transformer and Ballast Divisions of General Electric Co, Schenectady 5, N. Y.

The ballasts are available in the following Tulamp ratings: 300 ma for either 64T6 or 72T8 lamps; and 200 or 300 ma for the 96T8 lamp. Shorter in length than present designs, the ballasts are said to reduce noise level and watts loss.

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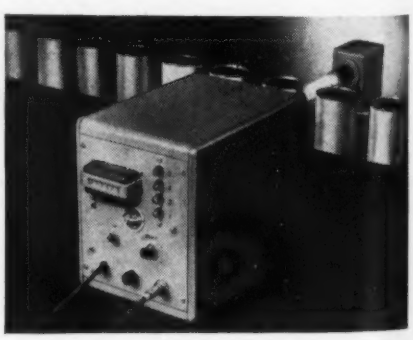
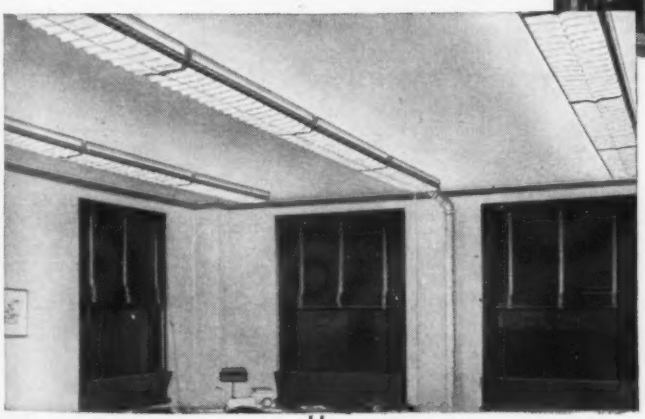


Photo-Electronic Counter

FOR COUNTING objects up to rates of 6,000 per min, Potter Instrument Co Inc, 136-56 Roosevelt Ave, Flushing, N. Y., has introduced the Model 310

6,000 SYLVANIA FLUORESCENT FIXTURES INSTALLED IN STANOLIND BUILDING

JOHN ECTON ELECTRICAL CONTRACTOR FOR BIG TULSA, OKLAHOMA JOB



▲ Continuous row installation of Sylvania CL-247 louvered fluorescent fixtures illuminates many of the executive offices.

▼ Virtually glarefree lighting creates ideal working conditions. Fixtures may be ceiling or pendant mounted, singly or in continuous row.

THE Stanolind Oil and Gas Company with headquarters in the imposing Stanolind Building, Tulsa, Oklahoma, has recently relighted the building with Sylvania CL-247 fluorescent fixtures.

These beautiful louvered fixtures, numbering about 6,000 in all, were installed by electrical contractor John Ecton of Tulsa. The fixtures carry two 40-watt Sylvania fluorescent lamps, and are typical examples of the kind of workmanship that makes for great ease of installation and maintenance, characteristic of the entire line of Sylvania Fluorescent Fixtures. Sylvania Electric Products Inc., Fixture Division, Ipswich, Mass.

SYLVANIA ELECTRIC

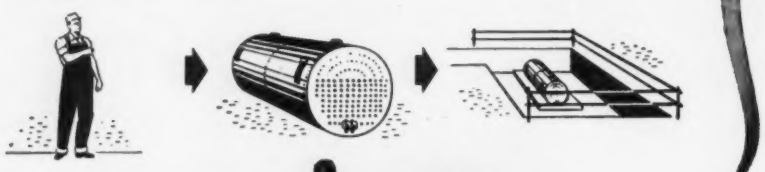
FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS; PHOTOLAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

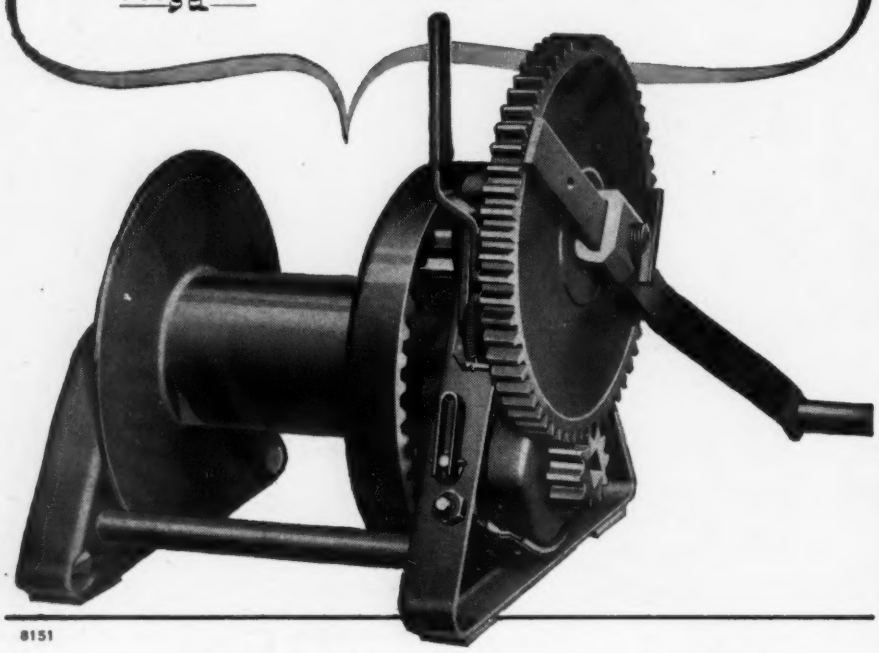
Would you believe . . .

that one man, with no power equipment . . .

can haul this heavy boiler . . .

out of this deep pit?





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HANDIWINCH

● It's easy as **ABC** . . . here's how he'd do it . . .

(A) Carries HANDIWINCH to the job. (B) Sets it up on any firm support. (C) Anchors it. (D) Using planks for a ramp, he fastens rope to boiler and hauls it up and out.

Stoutest, most ingenious small winch ever built, HANDIWINCH and *one man* can handle any lifting or pulling job up to 10,000 lbs. All steel construction . . . cut gears . . . two power ratios . . . powerful hand brake . . . many "big hoist" features.

Ask your distributor . . . or write direct for folder HW-15, showing many typical HANDIWINCH set-ups.

American Hoist

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St. Paul 1, Minnesota

Plant No. 2: So. Kearny, N.J.

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For Armored Construction . . . specify

AMERICAN BLOCKS AND SHEAVES

A wide line of wire rope blocks—many types, all sizes, in capacities from 1½ to 250 tons. Thick steel side plates, heavy pins and axles. Ask for American equipment when ordering.

For fastening wire rope, use genuine

CROSBY CLIPS

Hot-dip galvanized—high wings—grooved saddle—precision cut threads. To make sure you get genuine CROSBY CLIPS, look for the famous Red U-Bolt. All sizes—⅛ to 3 inches. Distributors everywhere.

photo-electronic counter. The device includes a photo-electric detector, one electronic decade and a six place electromechanical register in one container, and a light source in separate housing.

By indicating the last digit on neon glow lamps and the other six on the mechanical register, the counter provides a registration of seven digits. The device uses a ¼-in. wide light beam and responds to light changes as small as 25%, according to the manufacturer.

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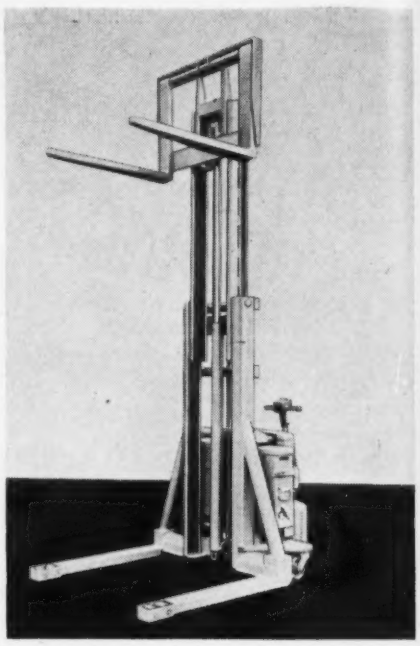


Stacking Truck

TELESCOPIC TYPE truck, known as Jackstacker, 100% electrically operated, with capacities up to 4000 lb, has been added to the line produced by Lewis-Shepard Products Inc, 274 Walnut St, Watertown 72, Mass. The unit has hydraulic lifting and lowering mechanisms and gear drive.

All controls are operated from the handle head with handle in vertical or any other position. The truck has two speeds forward and reverse. Master Drive Unit, including traction mechanism, is mounted on articulated linkage to insure adequate traction over uneven surfaces, ramps and sills.

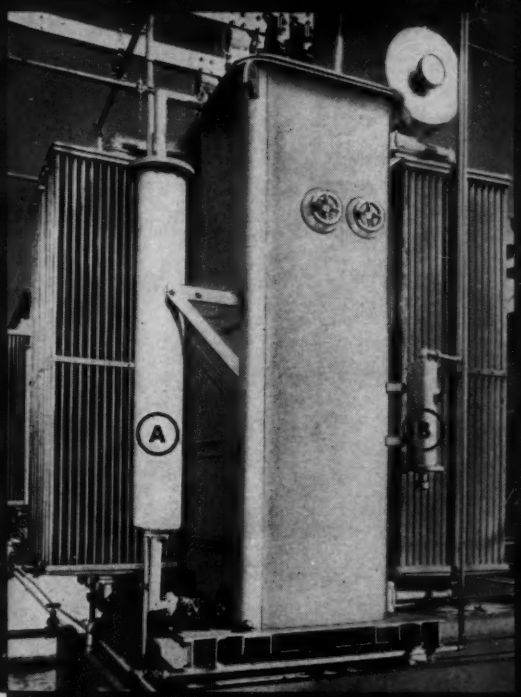
•

Photoelectric Controller

FOR MAINTAINING alignment of sheet material during automatic packaging, printing, labelling and cut-off operations, the photoelectric Registration Control 23LF3 has been developed by Photoswitch Inc, 77 Broadway, Cambridge 42, Mass.

The controller features the split-beam scanning head, a single lens handling both transmitted and reflected light.

there's Real Economy in transformer oil maintenance



It's easy to maintain your insulating oil and prevent contamination from acid, sludge and moisture. Two simple devices filled with ALCOA Activated Alumina, and attached to your transformers, will do the trick.

A by-pass filter (A) and a breather unit (B) employing pressed blocks or standard perforated cans of ALCOA Activated Alumina, effectively save transformer oil by:

1. Reducing acids already existent and preventing accumulation of acids.

2. Preventing destructive effects of oxidation of the oil, thus eliminating the formation of sludge and other oil-insoluble products of oxidation.

3. Eliminating entrance of moisture into the transformer through the breather and continuously removing moisture which may be already present.

4. Maintaining and improving the dielectric strength of the insulating oil.

That's *real* protection!

In our own Alcoa, Tennessee, Power Division, we have saved more than $32,000 annually by protecting transformers and other power plant equipment with Activated Alumina.

That's real economy!

We'll gladly supply additional information that will help you protect *your* power equipment with Activated Alumina. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 1783 Gulf Building, Pittsburgh 19, Pa.

ALCOA

ALCOA CHEMICALS

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ACTIVATED ALUMINAS • CALCINED ALUMINAS • LOW SODA ALUMINAS • TABULAR ALUMINAS • HYDRATED ALUMINAS
ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE

The Trend is Toward

CRESCENT SYNTHOL TYPE TW

•

ONE GENERAL PURPOSE WIRE AT LOWEST COST
APPROVED FOR DRY, WET AND OILY LOCATIONS

•

CRESCENT SYNTHOL Building Wires and Cables are insulated with a special, tough, thermoplastic compound that results in wires of unexcelled Permanence, Safety, Adaptability and Value. They combine high dielectric and mechanized strength with the following desirable features.

RESISTANT to moisture, acids, alkali and most chemical solvents.

OILPROOF—cutting oils, greases and petroleum lubricants do not injure SYNTHOL.

SMALL DIAMETER—has smallest outside diameter for same conductor size, permitting more conductors, or larger conductors in same space.

FLAME-RETARDING—SYNTHOL insulation will not support combustion.

BRIGHT COLORS—non-fading, the insulation is the same color throughout so color will not scrape off; easily cleaned; twelve colors.

FREE STRIPPING—makes splicing and soldering easier and faster.

EASY PULLING—because SYNTHOL wires have a permanent clear wax lubrication on their hard, smooth, abrasion-resistant surface.

CRESCENT WIRE and CABLE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

The circuit will respond to impulses of 0.001 sec duration.

The unit is energized from both opaque and transparent web materials; can control either light or dark registration marks; and may be used with continuous or intermittant feeds.

Operating from a 115-v 60-cycle source, the controller is claimed to produce 1000 va through a single-pole double-throw relay.

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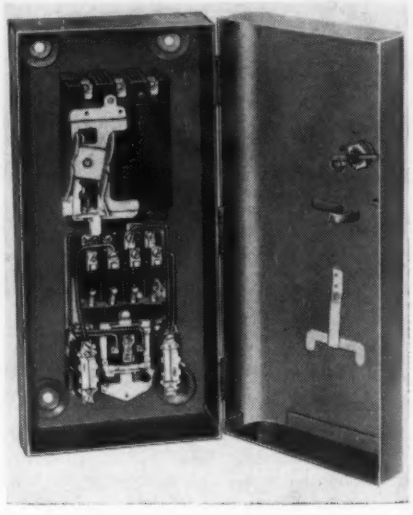


Magnetic Starter

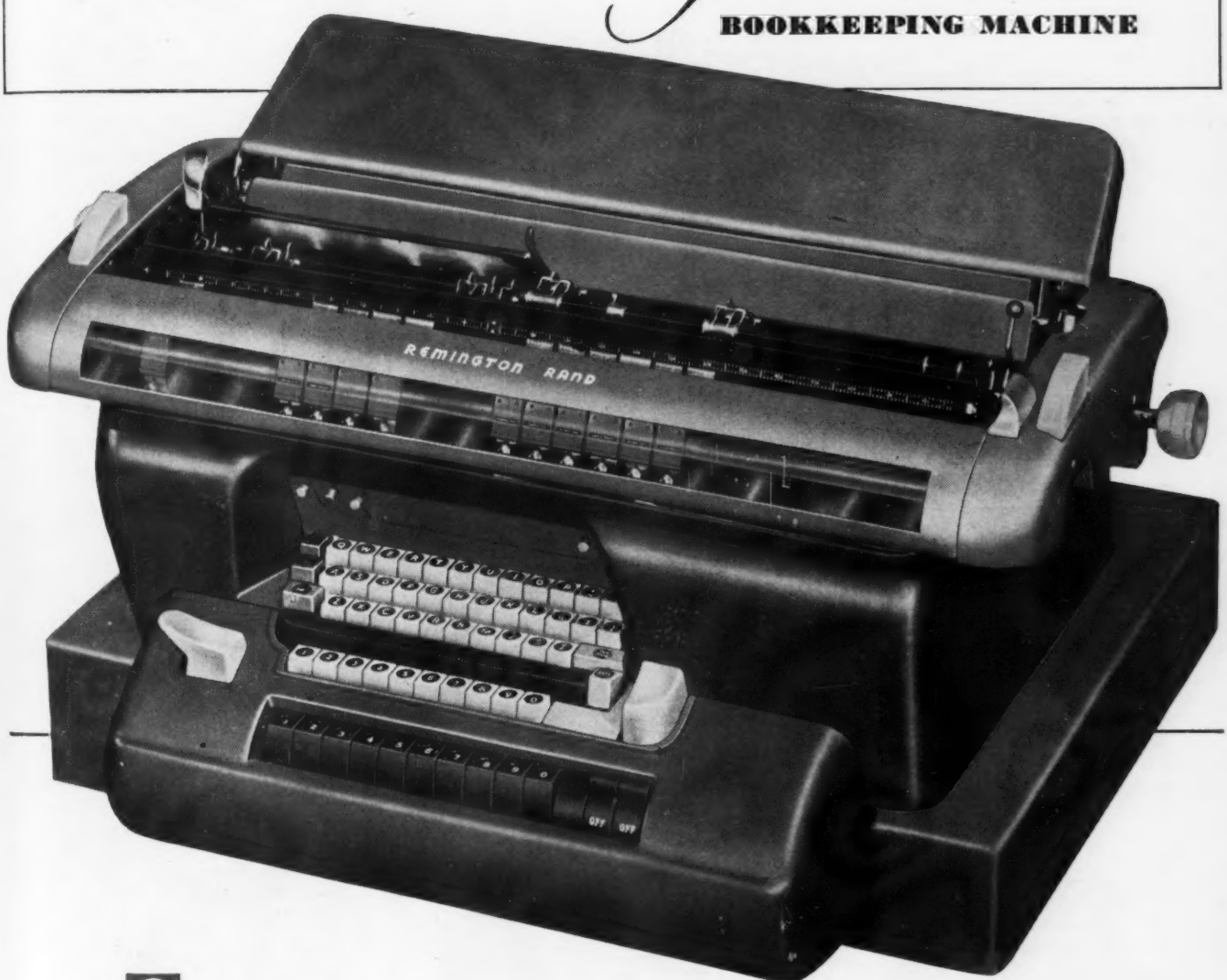
WARD LEONARD Electric Co, Mount Vernon, N. Y. has developed the Bulletin 4130 a-c combination magnetic starter with circuit breaker. This starter is said to fulfill NEC requirements for motor branch-circuit overcurrent protection, disconnect means, motor-running overcurrent device and motor controller.

The unit consists of a magnetically operated contactor with thermal inverse-time-delay overload relays combined with a thermal type circuit breaker. Bulletin 4130 starters are

IT'S NEW

THE NEW REMINGTON RAND *Foremost*

BOOKKEEPING MACHINE



New efficiency in public utility accounting procedures is yours with the new "Foremost" bookkeeping machine. This completely electrified machine is new from core to keyboard.

New mechanical features speed every machine operation: high-speed spacing and timing give you faster computations and tabulations, faster automatic printing of all balances, faster carriage return and line spacing.

New functional design simplifies every operator motion: front-feed carriage construction provides "one-operation" insertion, collation and alignment of forms... new, scientifically designed keyboard with finger-grooved, organ-type keys assures simpler posting... new magnification of register totals eases reading and transcribing.

See this new machine produce public utility records with new efficiency. Call that Remington Rand man near you, or write to Dept. EL-12, 315 Fourth Ave., New York 10, N. Y.

Remington Rand

NORTH • EAST • SOUTH • WEST • IT'S SCHRAMM!

CHOOSE *as others have* **THE MODEL THAT BEST FITS YOUR NEEDS!**

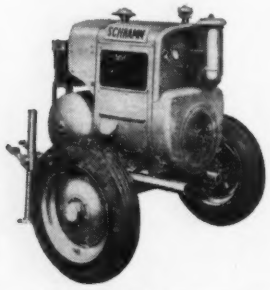
There's a Schramm Air Compressor, size and model, to meet your specific needs!

Below are listed six of the many Schramm models, portables ranging from 20 to 420 cu. ft. of actual air, the stationary ranging from 2 to 600 cu. ft. displacement.

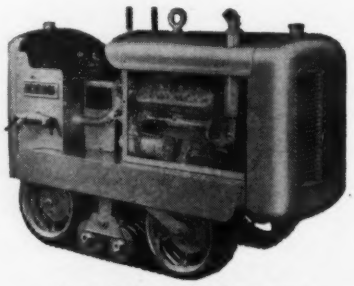
On all models performance records are evidence of their high quality. You will find the name Schramm written on every important page in compressor history.

Features you get in Schramm are: 100% water cooled, assuring ideal performance summer and winter; mechanical intake valve, forced feed lubrication, and electric-starter starting. All Schramms are compact, lightweight, easy to operate.

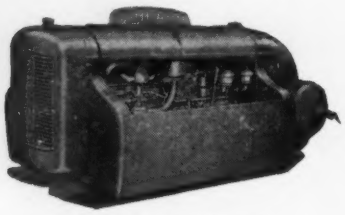
We invite you to write today for fully illustrated catalog describing in detail each of the Schramm Air Compressors shown here . . . plus a wide range of other models. We feel the Schramm story is a good one, and offers you a sure way to get your many compressed air jobs done quickly, efficiently, and economically.



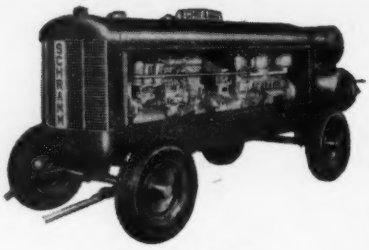
20/35 Model Compressor



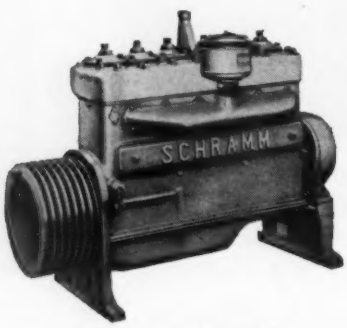
No. 60 Self-Propelled Compressor



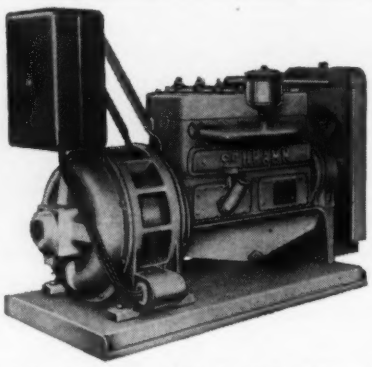
Skidded for Truck Mounting



Diesel Engine Drive



"V" Belt on Flat Pulley Drive



Built-in Motor Drive with Cooling Unit and Starter

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

available in five sizes to 200 hp, 3 phase, 550 v, 60 cycles. They can be supplied with reset button only in cover and with local control pushbuttons or "Hand-Off-Auto" selector switches.

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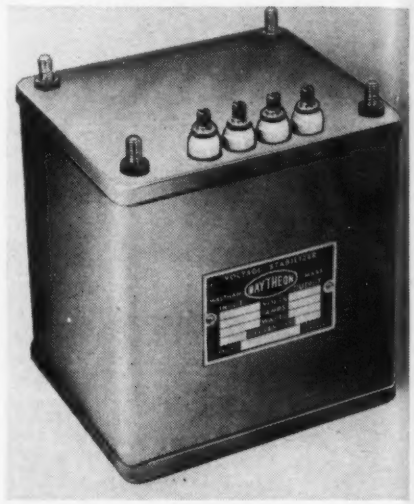

Voltage Stabilizer

BUILT to resist shock and vibration, the VR-6000 voltage stabilizer is produced by Raytheon Mfg Co, Waltham 54, Mass.

A hermetically sealed, frequency compensating model of 15-w rating, the VR-6000 is designed for a frequency input of 57–63 cycles, a voltage input of 95-125 v and an output of 115 v. The manufacturer reports both line and frequency regulation to be plus or minus 1%. The model is oil cooled and has stainless steel mounting studs.

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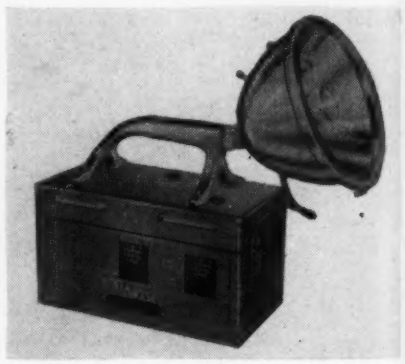


Portable Lamp

EQUIPPED with a built-in charger, a portable lamp known as Big Beam No. 312 has been announced by U-C Lite Manufacturing Co, 1050 W. Hubbard St, Chicago 22, Ill. The unit is powered by a 4-v, 20-amp-hr storage battery housed in a plastic case that is said to be acidproof and also spillproof regardless of lamp position.

The container is a welded steel case,

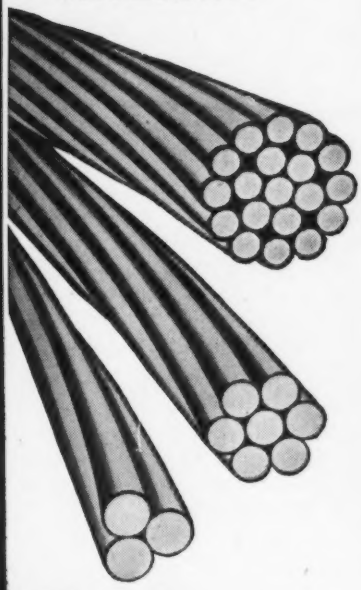
PAGE

Stainless Steel

STRAND

for

GROUND
GUY
MESSENGER
CATENARY



Higher

in Corrosion Resistance
Tensile Strength
Elastic Limit
Resistance to Vibration
Strength to Weight Ratio

Lower

in Cost per Year of Installed Life

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ACCO

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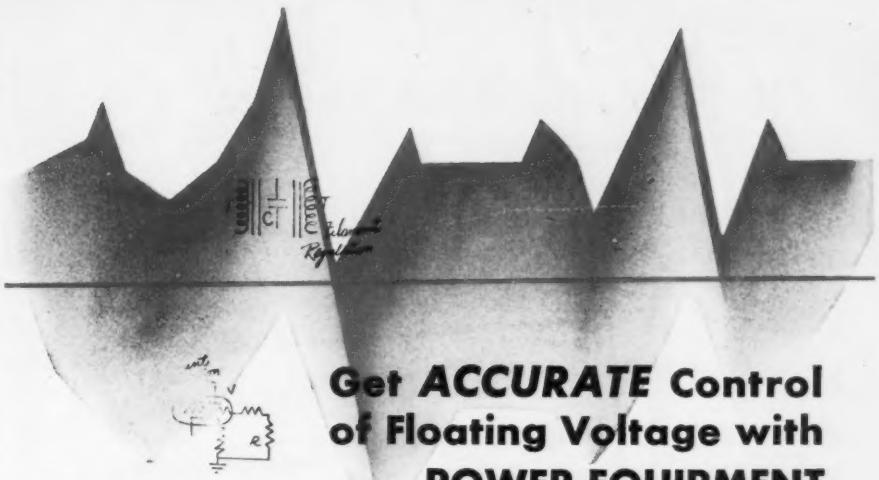
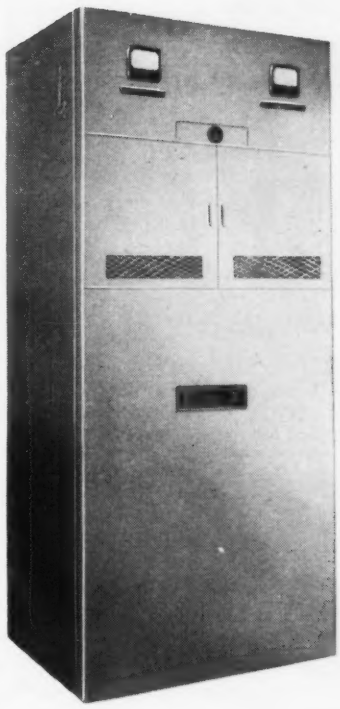
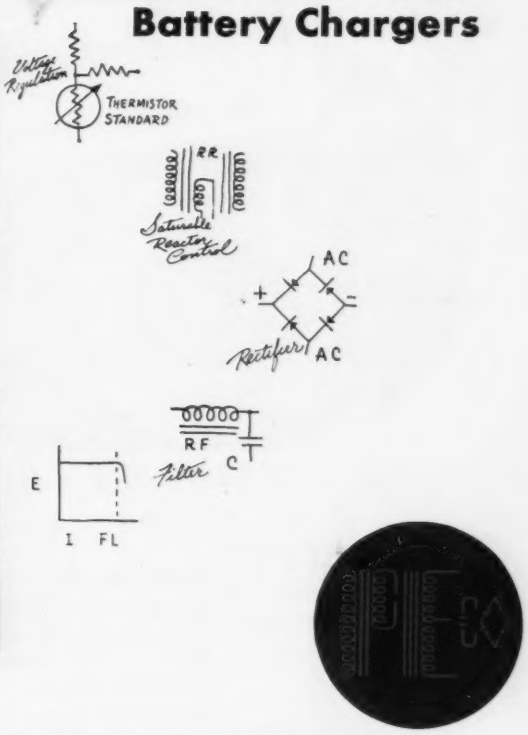
In Business for Your Safety



Get *ACCURATE* Control of Floating Voltage with POWER EQUIPMENT Battery Chargers





You can increase battery life, reduce maintenance and supervisory costs through the use of simple, compact Power Equipment Battery Chargers. How? Why? First, because they give you accurate control of floating voltage . . . within ± 1% . . . which entirely eliminates the life-absorbing effects of over or under charging. Second, because they're fully automatic in operation . . . electronically or magnetically controlled and regulated . . . designed especially to provide dependable, efficient, trouble-free charging at lowest possible cost. And important, too, they're the tested, proven products of over 13 years specialized experience in the field of controlled rectifiers. Standard models up to 10KW . . . write today for complete information.

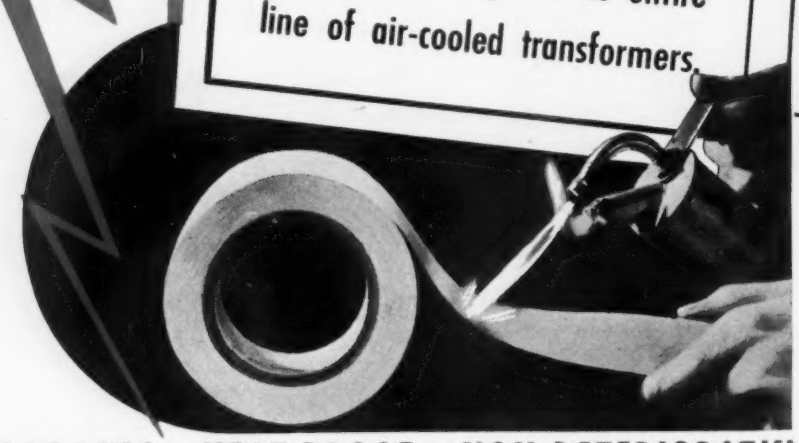
POWER EQUIPMENT *Company*

Specialists in Controlled Rectifiers Since 1935

55 ANTOINETTE STREET / DETROIT 2, MICHIGAN

NEW! A Good Transformer MADE BETTER!

MTC uses the new JOHNS-MANVILLE *Quinterra* insulation throughout its entire line of air-cooled transformers.



INORGANIC • HEAT-PROOF • NON-DETERIORATING ELECTRICAL INSULATION

AIR-COOLED TRANSFORMERS
1 to 1,000 KVA up to 15,000 Volts to meet Individual Requirements

- DISTRIBUTION
- GENERAL PURPOSE
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING

Insulation determines the working life of an air-cooled transformer. Marcus Transformers have always been known for their use of superior Class B and C heat-proof insulation. In this phase of construction, MTC has pioneered many noteworthy firsts. AGAIN, MTC is pioneering in the use of *quinterra* throughout its entire line of air-cooled transformers. That's why when air-cooled transformers are specified or needed, the reputation of Marcus stands pre-eminent in its field. That's why we invite your inquiry with confidence, knowing that once you have utilized a Marcus air-cooled Transformer, you will specify no other.

GOOD DELIVERIES • FIRM PRICES
NO ESCALATOR CLAUSES

MARCUS TRANSFORMERS CONFORM TO THE STANDARDS OF N.E.M.A. AND A.I.E.E.

MARCUS TRANSFORMER CO. INC.
30 MONTGOMERY STREET
HILLSIDE 5, NEW JERSEY

PIONEERS IN THE FIELD OF AIR-COOLED TRANSFORMERS

finished with baked enamel. A visual charge indicator shows the condition of the battery at all times. The chromium-plated steel lamp-head, 7 in. in dia, can be adjusted vertically through 170 deg.

A toggle switch permits control over the main bulb for producing a reported 2,000 ft beam or an auxiliary bulb for dim diffused light. Recharging can be done with 110 v a-c.

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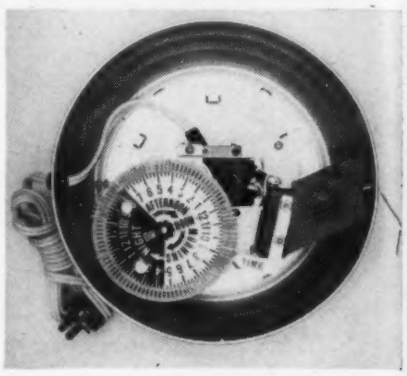

Heater Controller

THE TIME-A-TROL, an off-peak electric water heater control, has been introduced by the Control Division of the Hankscraft Co, Madison, Wis.

Dual warning devices are among the features of the controller. When current flows after an "off" period, a warning light and buzzer prompt the resetting of the clock to restore normal off-peak control. The off-peak switching mechanism is synchronized with a Telechron clock so that correct time on the clock automatically maintains correct off-peak switching.

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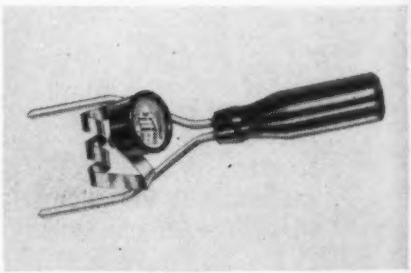
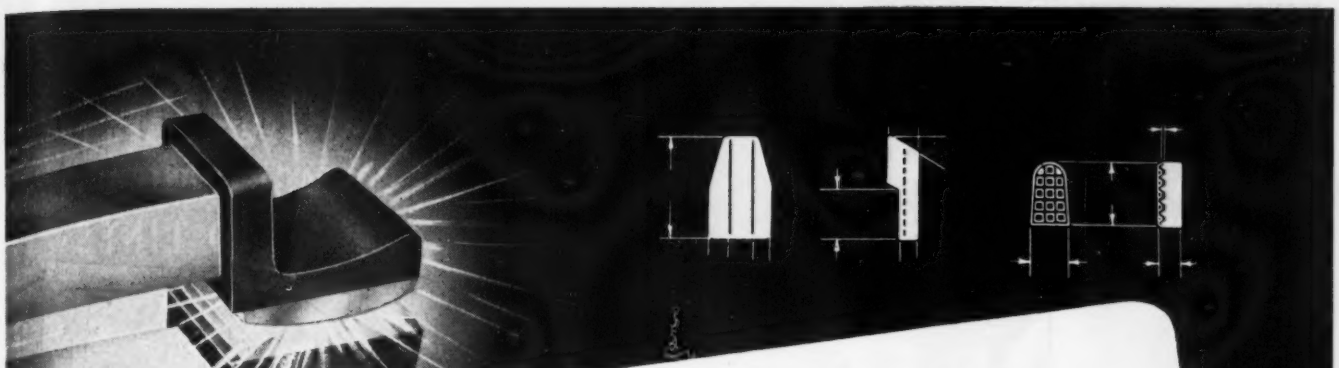


Cell Tester

FEATURING a one way reading scale that indicates OK, WEAK or DEAD, the High Discharge Cell Tester, No. 610A, is now being produced by Sterling Mfg Co of Cleveland, Ohio. The voltmeter has a spring movement.

Direct readings can be made to determine the condition of cells without removing the battery or connections. Resistance coil, terminals and voltmeter are combined in a single unit. The pointed terminals are spaced 3¾ in. apart. Instrument is 12 in. overall.



ON circuit breakers . . .

Motor controllers . . .

Transformer protective equipment

. . . Aviation relays . . . Contactors

. . . and similar equipment

Chances are . . .

STACKPOLE SILVER-TUNGSTEN CONTACTS can save you money!

One of the most remarkable contact developments of recent years, Stackpole Silver-Tungsten Contacts have scored an outstanding performance record on a long list of difficult applications.

In particular, they are ideally suited for assuring low contact resistance under continued operations where heavy arcs are present or under closed conditions. Exceptionally high characteristics of strength, density and conductivity make this performance possible.

CONTACTS "TAILORED" to YOUR EQUIPMENT

Actually, there are only a few standard grades of Stackpole Silver-Tungsten Contact materials. The procedure in most cases is to adapt the percentages of materials in the contact mix to the contact operating requirements of a specific application. Preferably, this calls for laboratory testing of different contact compositions on the equipment under actual operating conditions—and this is a service Stackpole is glad to render for contact users. Send details of your equipment and its applications and we will gladly recommend either specific contacts or a laboratory test procedure that may result in a worthwhile saving.

For a wealth of general contact information as well as specific data on Stackpole grades, write on company stationery for Stackpole Contact Catalog 12.

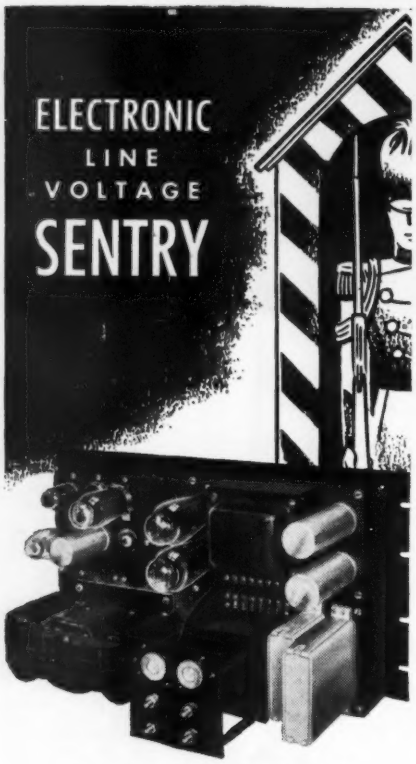
Grade	Composition % Silver	Cross Breaking Lbs. per Strength Sq. In.	Hardness Rockwell Superficial	Density	Electrical Conductivity Ag=100	Contact Resistance Estimated Ag=100
FW56	70	57,000	15T75	12.0	75	120
FW49	50	82,000	30T56	13.2	55	150
FW41	35	108,000	30T72	14.6	45	200
FW34	32	110,000	30T70	14.7	40	250

TYPICAL STACKPOLE SILVER-TUNGSTEN CONTACT MATERIALS

"Everything in Carbon but Diamonds"

STACKPOLE CARBON COMPANY, St. Marys, Pa.

STACKPOLE

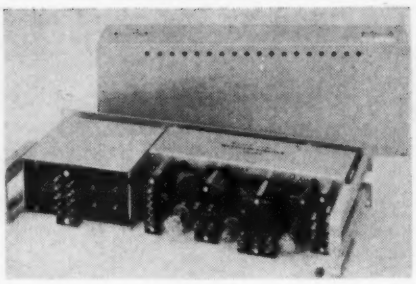


Rear View STABILINE Type IE

The Superior Electric STABILINE Automatic Voltage Regulator acts as a sentry — always "on duty" to maintain a constant voltage to electrical apparatus. Type IE, an *all-electronic* regulator, acts instantaneously to keep delivered voltage to within ±0.1 volts of the preset value, regardless of line variations. STABILINE Type IE will hold the output to within ±0.15 volts for any load current change or load power factor change from lagging .5 to leading .9. Waveform distortion never exceeds 3 percent — a negligible error not recognized in instrument readings.

Bulletin 547 gives you information on this and other Superior Electric voltage control equipment. Write for your copy today.

THE
SUPERIOR ELECTRIC
COMPANY
512 MEADOW STREET
BRISTOL, CONN.



FM Carrier Telegraph

IMMUNITY from interference by earth currents, lightning, static and weather change has been designed by Lenkurt Electric Co, 1108 Country Road, San Carlos, Cal., into an FM or carrier-shift telegraph system called Type 22. Interference-free operation is stated to be possible with eighteen 60-word-per-min channels between 420 and 2460 cycles or twelve 75-word-per-min channels between 425 and 2039 cycles.

To achieve fine filter sharpness, multisection networks have been utilized which incorporate toroidal coils wound on molded iron-powder cores. Silvermica and oil-filled capacitors are also used. All components are derated; plug-in relays are used; and circuits use industrial-type electron tubes. The units are constructed of aluminum, and transmitters, receivers and relays are mounted in separate panels for installation flexibility.

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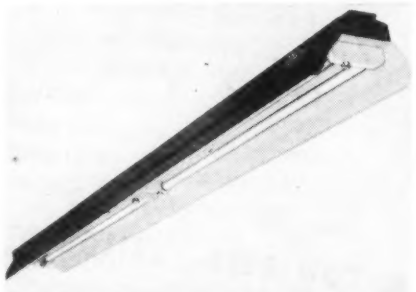


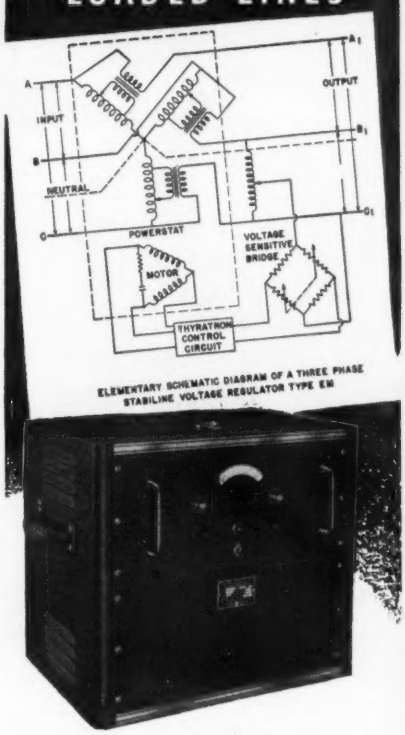
Industrial Luminaire

A SILV-A-KING fluorescent industrial unit—the Slimline—is being introduced by the Bright Light Reflector Co of Bridgeport, Conn.

Some features of the unit are: Safety spring action that keeps lamps from falling because of vibration; slide-grip hanger groove that runs the entire length of the unit to facilitate installation; E-Z Lok for easy assembly or disassembly of reflector from hood; and high power factor ballasts.

Top channel is one-piece, heavy gauge steel, finished in gray baked enamel. Reflectors come in either porcelain-enamel or baked enamel finish and are white inside and gray outside. This Slimline unit is UL approved.

MAINTAIN
CONSTANT
VOLTAGE ON HEAVILY
LOADED LINES



ELEMENTARY SCHEMATIC DIAGRAM OF A THREE PHASE STABILINE VOLTAGE REGULATOR TYPE EM

USE STABILINE ELECTROMECHANICAL VOLTAGE REGULATORS

In the plant — as in the laboratory — constant voltage is a necessity. It can be maintained to large industrial loads by using STABILINE (Electromechanical) Automatic Voltage Regulators.

These units feature zero waveform distortion; complete insensitivity to magnitude and power factor of load; no effect on system power factor; no critical adjustments; high efficiency; adjustable output voltage. Available for a wide range of applications in 115, 208, 230, 440 volt, single and three phase ratings; capacities to 100 KVA.

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for those interested in Industrial, Commercial or Residence Lighting

Covers 14 types of units under RLM Standard Specification and independent test*

Covers 9 types of Portable Lamps, 250 styles by 100 manufacturers, independently tested*

Covers product of 36 manufacturers cooperating under standard specifications and independent test*

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5 million Ballasts
sold last year, under standard specification and independent test*

Covers purposes

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- of INDEPENDENT TESTING
- of CERTIFICATION

*A copy (gratis) with the four enclosures (above) will be mailed you by writing E T L (below)

ELECTRICAL TESTING LABORATORIES, INC.

2 East End Avenue at 79th Street
New York 21, N. Y.

NEWS ABOUT PEOPLE

J. M. Stuart Assigned Broader Duties in Dayton

James M. Stuart has been appointed associate general manager and a director of the Dayton (O.) Power & Light

J. M. STUART

Co. In this capacity Mr Stuart will continue in charge of electric operations, and several other divisions of the company will be added to his responsibilities. He will continue as vice-president, to which position he was elected in 1947.

The highlights of his advancement in the company are assistant supervisor, underground department, 1930; supervisor, same department, 1937; manager of the electric division, 1942; manager and vice-president of electric operations, 1947; director and vice-president in 1948 of six Greenville (O.) subsidiary electrical properties acquired by Dayton Power & Light Co.

•

▶ FRANK HINTON has been elected president of the Fleming-Mason Rural Electric Cooperative Corporation, Flemingsburg, Ky.

▶ RAYMOND D. SHERMAN has returned to this country after 12 months as operations engineer of the Seoul Electric Co. The Korean administration has taken over operations of the property reconstructed by the American engineers of the U. S. Army military government.

▶ JOHN J. WINN, JR, who as vice-president and general manager of the Honolulu Gas Co, Ltd, did an outstanding job in rebuilding that war-worn utility, is returning to the United States. Although he resigned at the end of his two-year contract last March, he agreed to stay on for a while. Mr Winn was formerly industrial analyst for the National Bank of Portland. During the war he served in England as a colonel on the staff of the Chief of Engineers, in charge of engineering supplies for the European Theater of Operations. Earlier he was connected with Stone & Webster in New England, Consolidated Gas Electric Light & Power Co of Baltimore and in the Pacific Northwest with the Electric Bond & Share Co.

•

Ward Elected Executive V-P of Noma Electric

Joseph H. Ward has been elected executive vice-president of Noma Electric Corp, New York. Mr Ward joined

J. H. WARD

the Noma organization in 1927 and since 1938 has been a director and vice-president in charge of the company's decorative lighting division.

J. B. Wharton, Jr, treasurer of the corporation since 1945, has been elected vice-president and treasurer.

•

▶ FRED H. RENNERT has been appointed superintendent of the Keokuk power plant of the Union Electric Co. He succeeds PHILLIP M. CHAMBERLAIN, who retired after completing nearly 33 years' continuous service with the company. Mr Rennert was formerly mechanical superintendent at the Keokuk plant.

Moloney Appoints Mulcahy Vice-President, Sales

Edwin C. Mulcahy has been appointed vice-president in charge of sales of the Moloney Electric Co, St. Louis.

E. C. MULCAHY

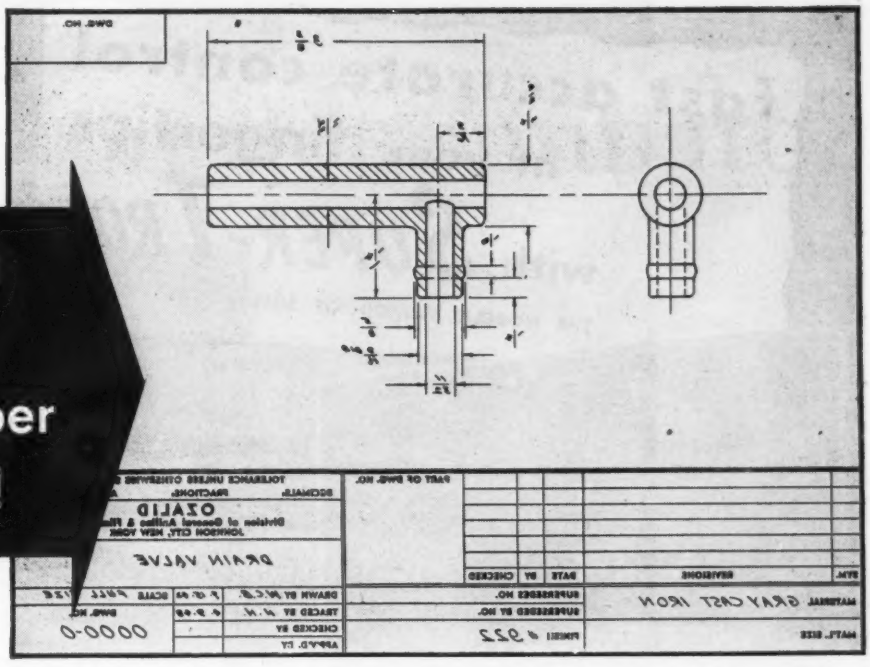
Mr Mulcahy has been connected with Moloney for 25 years. Beginning in the production department, he moved to the engineering department after two years and three years later entered the sales department.

•

▶ AUGUSTE BARIBEAU has been appointed assistant vice-president of the Shawinigan Water & Power Co, Montreal. Mr Baribeau has been with Shawinigan since 1930 and until his recent appointment was serving as assistant manager of the commercial and distribution department, with headquarters at Three Rivers, Quebec.

▶ HENRY H. STARTZMAN has been appointed assistant chief engineer of the Potomac Edison Co, Hagerstown, Md. The position of manager of the power sales and engineering department, vacated by Mr Startzman, will be filled by L. V. Milton. Mr Milton has been industrial representative of the power sales and engineering department. Mr Startzman has been with Potomac Edison since 1928, when he joined the company in Cumberland as manager of the merchandise department. Later that year he was transferred to the industrial engineering department in Hagerstown, and four years later he was appointed

You're looking at the NEW intermediate paper for mass users!



The drawing above was reproduced on the new Ozalith Intermediate Paper. This duplicate paper original gives you Ozalid prints of maximum line density.

This New Ozalith Paper Costs Little—Has Great Mechanical Strength—Washable, Plastic Surface!

If your operation demands the duplication of a large bulk of drawings and plans, this new Ozalith Intermediate Paper should be of great interest to you.

For it is the answer to the need for a reasonably priced (7½¢ per square foot) paper duplicate original having maximum possible toughness of base; permanence, for filing and record use; and highest reprint quality. It reprints at exceptionally high machine speed.

No Tendency To "Bleed"

The dye image will not offset or transfer to other papers or tracings with which this new Ozalith paper has been placed in contact. There is no tendency to "bleed."

Ozalith is coated on a 100% rag base of great mechanical strength. It will not deteriorate appreciably with age. It is the most durable intermediate paper known.

Pen And Pencil Additions

You can wash Ozalith with a damp cloth —dust, dirt, and grease will come off quickly. Water will not cause the base to cockle or the image to run.

Pen or pencil additions can easily be made on either side of an Ozalith print. Because of its high transparency, contact prints should be made, and additions then made on the unsensitized surface.

Ozalith is a running mate to Ozacloth —but because of its low price, it is ideal for mass users. Write, today, if you would learn more about this and other Ozalid prints.

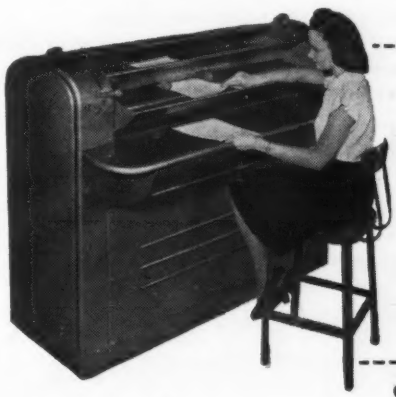
ALL OZALID PRINTS PRODUCED IN SAME MANNER

★ **No tie-ups when you shift from one type of print production to another. Simply choose your Ozalid material . . . and your Ozalid print-making machine exposes and dry develops it. Standard work prints are produced in 25 seconds.**

★ **Your drawings can be up to 42 inches wide, any length. Roll stock or cut sheets can be used. (Special machines accommodate 54" wide drawings.)**

★ **You—or anyone else—can be the operator. A few hours and you're an "expert."**

★ **See *all* the Ozalid prints you may make from any drawing . . . and learn full story. Mail coupon today.**



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OZALID . . . **A Division of General Aniline & Film Corp., Johnson City, New York**

Gentlemen: Please send free copy of Ozalid Streamliner booklet illustrating all types of Ozalid prints.

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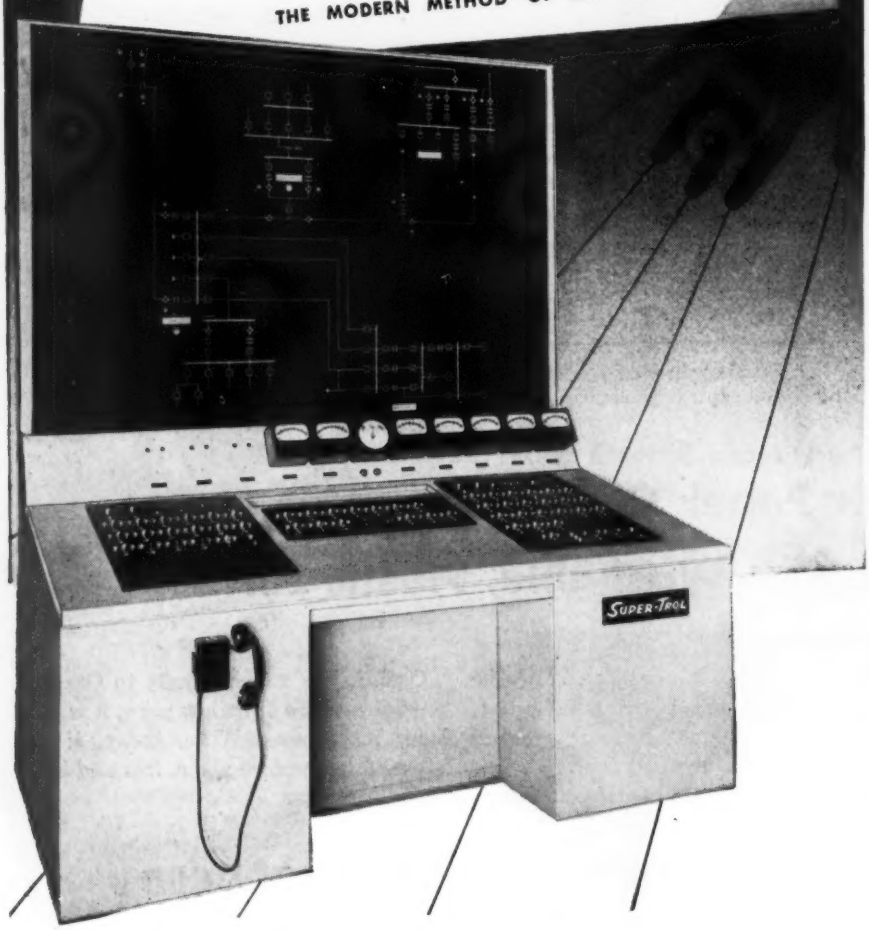
Ozalid in Canada—Hughes Owens Co., Ltd., Montreal

fast accurate control at your fingertips with SUPER-TROL

THE MODERN METHOD OF SUPERVISORY CONTROL



SUPER-TROL is today's answer to remote and continuous equipment control requirements in sub-stations . . . hydro-plants . . . pumping stations . . . and the numerous other places needing remote control.

PROVIDES FAST FINGERTIP CONTROL

Throwing a switch and pushing a button starts a generator . . . closes or opens a breaker . . . cuts out a transformer . . . meters voltage, current, or power at any point. SUPER-TROL is fast, positive, accurate, dependable.

TELLS OPERATION OF EQUIPMENT

SUPER-TROL tells at a glance the condition of all equipment. Gives fast indication of all automatic operations. Uses a single pair of wires or carrier current channel for any and all operations. Can operate simultaneously with telephone conversations.

NEW MAP BOARD SHOWS LOCATIONS

A visual aid showing location as well as operation of equipment. Very valuable in an emergency.

WRITE FOR DETAILS about SUPER-TROL.

It can help you solve your present and future supervisory control problems.

CONTROL CORPORATION

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• Super-Trol • Peak-Trol • Telemetering • Battery Chargers • Carrier Current •

manager of the power sales and engineering department. Prior to becoming identified with Potomac Edison in 1934, Mr Milton was connected with Westinghouse in the testing, power sales, and central sales departments.

•

GE Names Walker Manager, Construction Materials

Clarence C. Walker, formerly General Electric commercial vice-president assigned to customer relations work in

C. C. WALKER

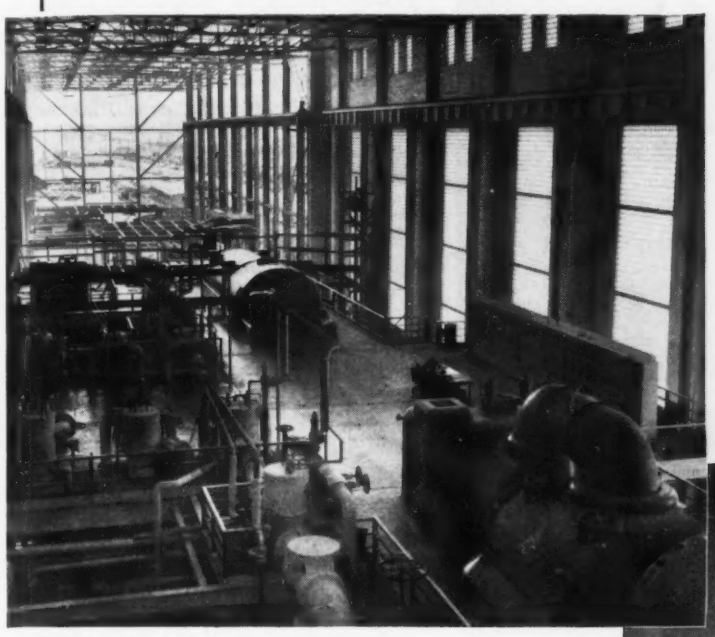
the New England area, has been appointed general manager of the company's construction materials department. Mr Walker, who will make his headquarters in Bridgeport, Conn., succeeds the late Carroll D. Hepler. In his new position, he will be responsible for the development, manufacture and sale of wire and cable, wiring devices, accessory equipment, and conduit products.

Mr Walker joined GE in Cleveland in 1921 and for the next 12 years was connected in various capacities with the Bryan Marsh division of the lamp department. In 1933 he was transferred to Boston as assistant manager of the lamp department's New England sales district, and five years later was named manager. He was appointed commercial vice-president in Boston last year.

•

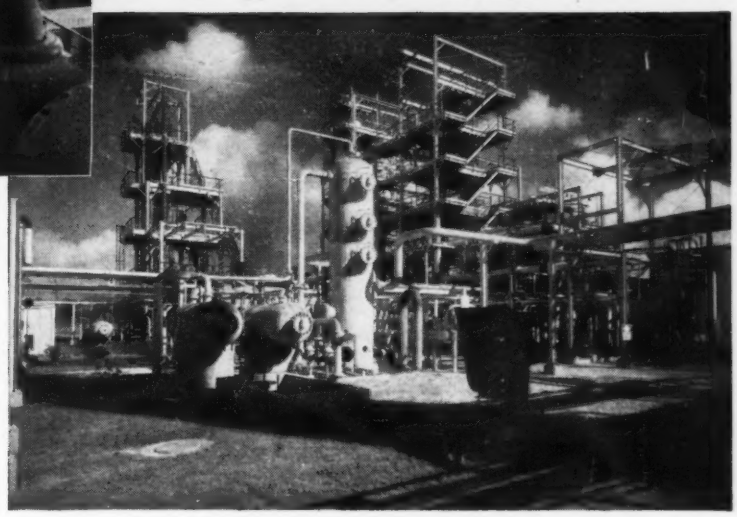
► C. W. CUTLER, consulting power engineer in Seattle, Wash., has joined Seattle City Light as Skagit project engineer, a new position. H. V. STRANDBERG, formerly supervising senior engineer in charge of electrical design and construction, has been appointed projcet engineer on a 230-kv transmission line from Ross Dam to the city and a multimillion dollar receiving substation at Bothell, north of Seattle. HUGH SILLIMAN, formerly Mr Strandberg's assistant, now is supervising senior engineer in charge of distribution design and construction. ROBERT P. SONNTAG, formerly

THE Common denominator



Interior view of First Section of new Redondo Steam Station of Southern California Edison Company, now under construction at Redondo Beach, California.

Crude Alcohol Unit of the Esso Standard Oil Company's Refinery at Baton Rouge, Louisiana.



Experience is the common denominator which is essential to the success of any project, large or small. The many years of experience of Stone & Webster Engineering Corporation in engineering, design and construction covers a wide range of diversified projects.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

The 7-Range Clip-On Volt-Ammeter

FERRANTI

Offers These Important Advantages

- Measures up to 1000 amps—up to 600 volts.
- Convenient ONE HAND operation trigger action.
- Thumb operated range selector switch.
- 7 ranges—5 current and 2 voltage.
- Insulated core—shockproof construction.
- Takes cables up to 2¼" diameter.
- Distinct calibrations—easy to read.
- Suitable for 50-70 cycles.

RANGES: 0-10 *amps;* 0-25 *amps;* 0-100 *amps;* 0-250 *amps;* 0-1000 *amps;* 0-150 *volts;* 0-600 *volts.*

FERRANTI ELECTRIC, INC.

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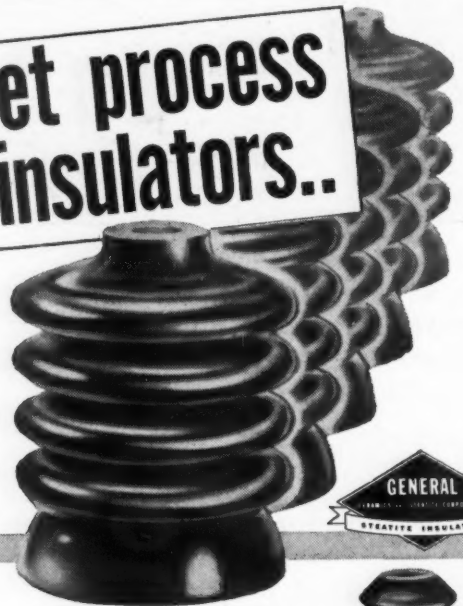
FERRANTI, LTD., Hollinwood, England — FERRANTI ELECTRIC, LTD., Toronto, Canada

wet process insulators..



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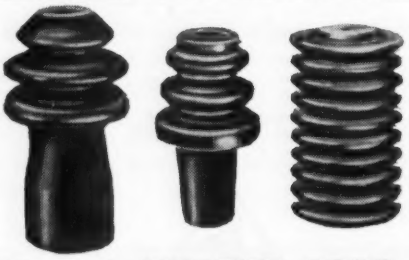
—available now for immediate delivery!

Yes—Wet Process Electrical Insulators are in good supply at General Ceramics now. No matter what quantity you need, you can count on immediate delivery and a steady supply. All are engineered and manufactured to the same high standards that, for years, have made General Ceramics steatite insulators and sealed leads the accepted standard in the electronic and electrical industries.

IF YOU NEED porcelain insulators for any application—high or low voltage—call or write us, today. We'll do the rest . . . and fast! Inquiries obligate you in no way whatsoever.



General CERAMICS and STEATITE CORP.

KEASBEY • NEW JERSEY

Makers of Steatite, Titanates, Zircon Porcelain, Alumina, Light Duty Refractories, Chemical Stoneware

assistant resident engineer at Ross Dam, has become resident engineer on the Gorge project. Mr Cutler was connected with the General Electric Co from 1920 to 1942. Following military service, he established a private practice in Seattle.

▶ WARD HARRISON, who recently retired from his position as director of engineering of General Electric Co's lamp department at Nela Park, has been elected a director and consulting engineer of the Thompson Electric Co, Cleveland.

▶ R. B. RODRIGUEZ, manager of Allis-Chalmers de Mexico, S. A., has been elected to the presidency of the American Chamber of Commerce of Mexico. The Chamber of Commerce is made up of 1,000 Mexican and American business men whose aim is to promote commercial relations between the two countries.

▶ FRED C. TODD has been appointed manager of the protective equipment sales department of the Line Material Co, Milwaukee, Wis. Mr Todd joined the company in 1939. In 1941 he moved to the Tennessee territory, where he held the position of Memphis district manager. Mr Todd is a member of the American Institute of Electrical Engineers. His office will be located at L-M's South Milwaukee plant.

▶ ROBERT C. HILL has resigned as director of the appliance division of the National Electrical Wholesalers Association to organize a management consultant firm under the name of Bob Hill & Associates. The new firm will specialize in serving the electrical appliance distributive industry, both the wholesaler and the dealer. Mr Hill has been identified with the electrical industry for more than 25 years.

▶ EVERETT B. WILLIAMS, general industry manager of the Sturtevant division, Westinghouse Electric Corp, Boston, retired recently. He began his career as an electrical test engineer at Brooklyn Navy Yard in 1903. Mr Williams joined the then B. F. Sturtevant Co in 1905 as electrical superintendent. In 1930 he was appointed vice-president in charge of naval and marine work. In 1946, when Westinghouse acquired the company, he was named to the position he held at the time of his retirement. Business associates presented him with a television set at a dinner in his honor.

▶ CONDA P. BOGGS has been elected president of Victor Electric Products, Inc, Cincinnati, a subsidiary of the Maxson Corp. Mr Boggs was formerly vice-president of Sylvania Electric Products, Inc. He joined Sylvania in 1932 as

This—

—or this?

The KNOPP Voltage Tester with the PROD-MOUNT

Has 5 Safety Features

Say "Goodbye to risky, time-wasting fuss in testing" with the 5 main safety features in the Knopp Voltage Tester: (1) exclusive Prod-Mounting Socket in housing making this tester easier, faster, and safer to use and ending time-wasting "three-handed" testing; (2) protection through DUAL indication of voltage by solenoid and neon lamp working independently; (3) positive scale reading; (4) signal by hum and vibration; and (5) thorough insulation throughout, even to the sharp point of each prod.

Well built and shock-proof in a LAMINATED bakelite housing, the Knopp Voltage Tester tells immediately and simply if circuit is open or closed; magnitude of voltage between 110 and 600; a-c or d-c, pure or rectified; 25 or 60 cycles —for testing old and new circuits, fuses, locating grounds, etc.

Get the widely-used and reliable Knopp Voltage Tester with the Prod-Mount, and other safety features, from your dealer, or write for illustrated, free information sheets.

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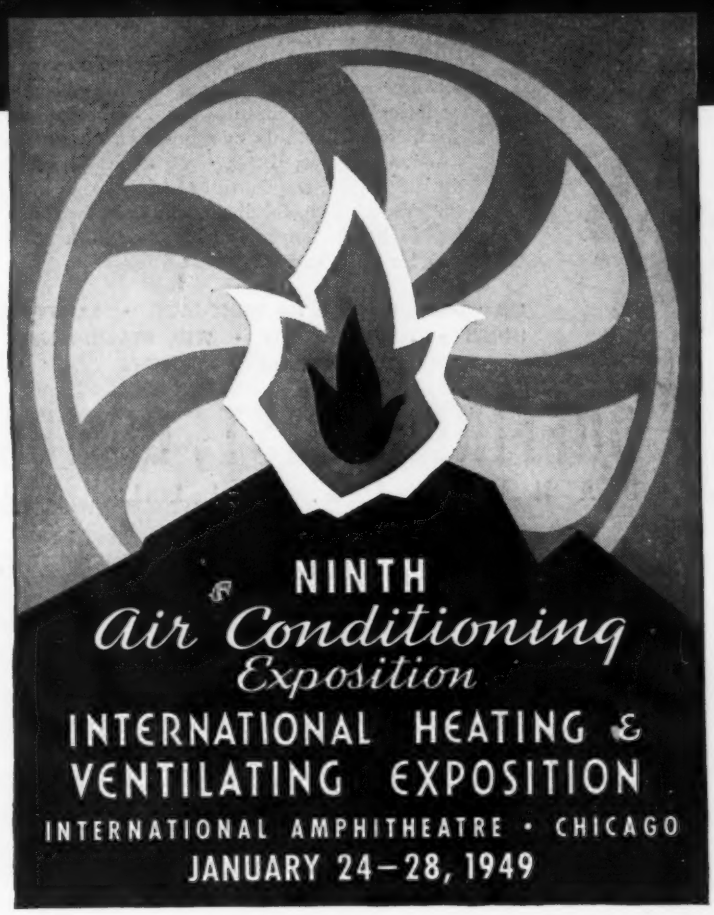
4236 HOLDEN ST., OAKLAND 8, CALIF.

PROGRESS ON PARADE at the

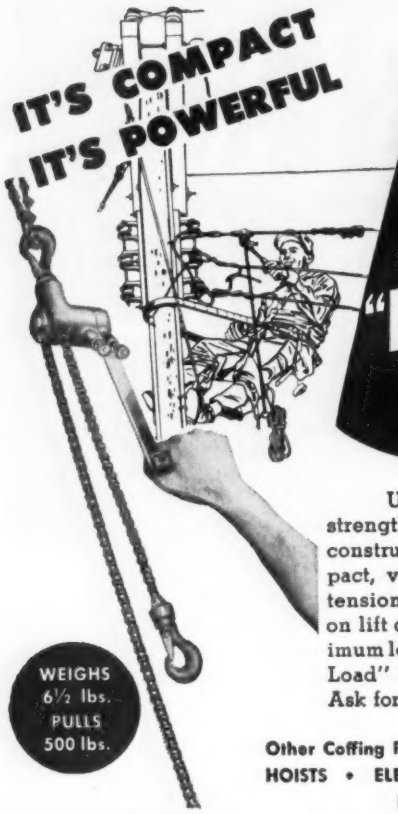


Under Auspices of American Society of Heating & Ventilating Engineers.

Striking advances in equipment . . . the latest trends and practices . . . newest and best ways to efficiently heat, ventilate and air condition all types of commercial and public buildings, industrial plants, institutions and homes . . . a wealth of practical, business-building ideas . . . are in store here for utility commercial departments and power sales engineers. Greatest display of its kind ever held, its informative, technically-staffed exhibits and demonstrations will afford unequalled opportunity to see and compare at one time hundreds of new and improved items from complete units to maintenance supplies . . . to discuss your specific interests, problems and requirements first-hand with manufacturers' engineering and sales staffs.

Because of today's rapid pace of progress, no one responsible for cultivating the sales opportunities in these active fields, can afford to miss this outstanding display of progress. So plan now to attend—note the date.

—Management International Exposition Company—



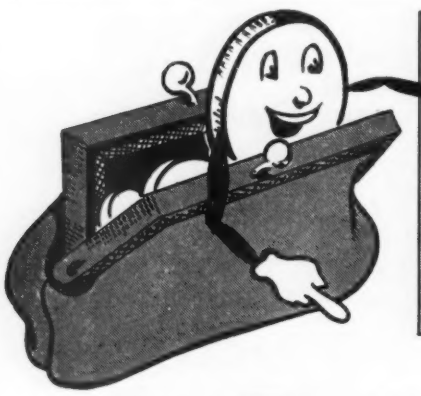
It's the NEW COFFING "MIGHTY-MIDGET" PULLER

Use the *new* "Midget" Puller to save time and strength on scores of jobs in utility and electrical construction and maintenance. One of the most compact, versatile tools ever made for tightening wire, tensioning guys, lifting equipment. 500 lb. capacity on lift or pull, requiring only 28 lbs. of effort at maximum load. Snaps on lineman's belt. Two-way "Safety-Load" handle serves as lever or high speed crank. Ask for Bulletin EMP-2.

WEIGHS 6½ lbs. PULLS 500 lbs.

Other Coffing Products: The HOIST-JACK • SAFETY-PULL HOISTS • ELECTRIC HOISTS • SPUR-GEARED HOISTS • LOAD BINDERS • TROLLEYS

COFFING HOIST COMPANY
DANVILLE, ILLINOIS



SCIENTIFIC WIRE STRINGING *Paid Off*

When temperatures drop, wires tighten up unmercifully. This was demonstrated repeatedly last winter when sub-zero weather caused wires to snap, and too-tight wires combined with heavy sleet and ice to bring many poles to the ground.

Some spans stayed up beautifully in the worst ice, sleet and wind of the season. They were the wires strung with Dillon Dynamometers to exact tensions recommended by the wire manufacturers. They were the ones where the relatively small cost of scientific wire stringing paid off.

As insurance against the next bad storms, check all guy and conductor tensions with Dillon Dynamometers. It isn't necessary to cut the wire. Above all, string all new wires the safe, scientific way.

The Dillon Dynamometer was created expressly for wire stringing. It's light in weight, compact and easy to use. Can be worked with a rope block, chain hoist or truck winch. It's dead accurate.

Dillon DYNAMOMETER

TO GET YOUR *free* COPY

of the "Rules of Successful Wire Pre-Stretching and Stringing," written by experienced linemen, drop us a note today.

W. C. Dillon & Co., Inc.

5410-C W. HARRISON ST. CHICAGO 44, ILL.

administrative assistant to the president, later becoming director of manufacturing. Earlier connections included the National Lamp Works, Cleveland, and RCA Radiotron Co, Harrison, N. J.

▶ Charles E. Wilson, president of the General Electric Co, has been chosen by the American Ordnance Association to receive the Association's Crozier Gold Medal for distinguished ordnance service. The medal will be presented at the Industrial Preparedness meeting to be held at the Waldorf-Astoria Hotel, New York, on Dec 6. Colonel Walsh cited "the distinguished service rendered by Mr Wilson as vice-chairman of the War Production Board during World War II and his leadership in the fields of science and industry, particularly as they relate to the national defense of the United States. Mr Wilson has devoted much time and energy to the advancement of industrial mobilization plans and his company has undertaken many important operations in the field of research and production for the Armed Forces."

▶ James B. Fisk, director of the division of research of the Atomic Energy Commission, has resigned. He will soon assume new duties as professor of applied physics at Harvard University.

▶ Harry G. Hall, superintendent of underground lines of the Detroit Edison Co, has retired after 43 years of service. He had been superintendent of underground lines since 1930. Lemore W. Clark has been appointed to succeed him.

▶ C. B. Dick has been appointed works manager of the East Springfield appliance division plant of the Westinghouse Electric Corp. Mr Dick succeeds James R. Weaver, who has been appointed to a similar position with the Baldwin Locomotive Works, Philadelphia. Mr Dick has been identified with Westinghouse since 1918.

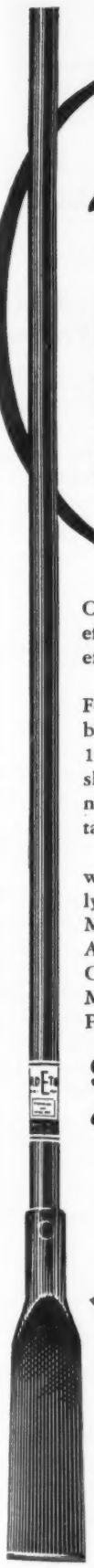
OBITUARY

▶ Theodore H. Pierce, 46, an electrical engineer for the Puget Sound Power & Light Co, Seattle, Wash, died there Nov 8.

▶ Roland Fitch, Sr, formerly general manager of the Kentucky-Tennessee Light & Power Co, Bowling Green, Ky., died on Nov 12 following a short illness. He was 67 years old. Mr Fitch had been connected with the Kentucky-Tennessee utility for about 40 years. He was a native of Lebanon, Ky. Since his retirement from the utility about ten years ago he had been engaged in the real estate and investment business.

the New

Electric Digging Spud



Combines the utility of an efficient digging spud and effective tamper in one tool.

Heavy duty construction. Forged, heat-treated chisel bit, 3¾ inches wide; rigid 1⅜ inch seamless tube shaft; a tamping head with nearly 15 sq. inches of tamping area.

Length over-all 9 feet—weight 21 pounds. A highly efficient extra value tool. Manufactured by The American Fork and Hoe Company, Cleveland, Ohio. Makers of True Temper Products.

STURDETOOLS
a **TRUE TEMPER PRODUCT**

Forged, heat-treated chisel bit. Tamping head has nearly 15 square inches of tamping surface.

Distributed by
JOSLYN MFG. & SUPPLY COMPANY
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

While your town sleeps...

this load-builder works—for you!

And look!

Two General Electric Automatic Blankets equal the kilowatt-hour load of one six-foot refrigerator!

General Electric Automatic Blankets boost your load when you need it—*from midnight to morning!*

And right now is your chance to make the most of this off-peak load builder—by tying in with those big selling months—November and December!

Feature the Automatic Blanket in your advertising and promotion. Tell your customers what a wonderful Christmas gift it is!

Tell them about the all-night coziness of General Electric Automatic Sleeping Comfort. (Already, more than half a million people are praising this wonderful way to sleep snugly under *one* light cover, even on wintry nights.)

To back you up, we're running beautiful four-color pages in *Life*, *House Beautiful*, *Good Housekeeping*, *National Geographic*, including a special Christmas gift ad.

And there'll be frequent mentions on "The G-E House Party," coast-to-coast air show over CBS.

For full information about this great off-peak helper (including enthusiastic statements from leading utility executives), write at once to Appliance and Merchandise Dept., General Electric Company, Bridgeport 2, Connecticut.

Automatic Blanket

"Goes to work when the lights go out"

Approved by Underwriters' Laboratories, Inc.

Certified washable by American Institute of Laundering.

GENERAL ELECTRIC

MANUFACTURERS and MARKETS

STUDENTS in first class of the Gould school on storage battery care and maintenance work in the laboratory under the direction of Don Huntsberger, wearing goggles, service supervisor. A series of such "schools" is being conducted by the Gould Storage Battery Corp at its Trenton, N. J., plant. The course covers storage battery theory, battery design, electrical theory, battery layout, charging methods, and maintenance procedure

GE Dedicates $3,000,000 Motor Plant in San Jose

General Electric Co has opened a new $3,000,000 plant in San Jose, Calif., which ultimately will produce all the company's output of single-phase integral horsepower motors.

At peak production, expected to be reached early next year, the plant will turn out more than 1,500 motors weekly. These will include the single-phase motors and 5 to 500 hp polyphase motors for irrigation pumps.

H. V. Erben, GE Vice-president, who spoke at the formal dedication, reported that the company's Oakland transformer factory is being converted into a self-contained unit for the complete manufacture of transformers. These units, in the 1½ to 1,000 kva range, will provide improved service for utilities and industries in the West.

Mr Erben also announced that a new industrial control equipment factory will be started in the company's recently expanded wire and cable plant in Oakland. Beginning as an assembly operation, the control factory will be developed to meet the requirements of western industry.

Annual production of GE's facilities in the West, including the Oakland Works in Oakland and San Jose, the Oakland lamp factory, the Ontario, Calif., flatiron plant, and the Trumbull Electric Manufacturing Co's three western factories, now total $48,000,000, Mr Erben said.

•

Canadian Carrier to Make Air Conditioning Units

Manufacture for the first time in Canada of Carrier Corp's line of fan coil-units for air conditioning and industrial heating blower-type cold diffusers and air washers is planned by Carrier Engineers, Ltd, Canadian subsidiary of the U. S. company.

New specialized machinery is to be installed in a 23,000 sq ft area leased in a new building near Toronto.

Combustion, Superheater Consolidation Planned

Consolidation of the assets and business of Combustion Engineering Co and the Superheater Co has been recommended by directors of both companies, subject to approval of stockholders at special meetings on Dec 22. If sanctioned, the merger will become effective Dec 31 and the organization will be known as Combustion Engineering-Superheater, Inc.

The companies have been closely associated since 1933, when Superheater acquired a 75% interest in Combustion Engineering. Superheater was organized in 1910, construction in 1914.

If the merger is consummated, the new company will have a capitalization of 1,200,000 shares of authorized stock, of which 978,316 shares will be outstanding. There will be no funded debt or other senior securities.

The merger terms provide that minority stockholders of Combustion Engineering receive three shares of capital stock of Superheater for each share of Combustion stock now held. The 75.13% stock interest in Combustion held by Superheater, together with $4,188,000 of first mortgage bonds also held by the latter, will be canceled.

Another provision of the proposed merger calls for the establishment of a twelve-member board of directors for the surviving corporation to hold office until the first annual meeting of the new company.

•

Supplies of Appliances Lag, Says T. J. Newcomb

Supplies of many major and minor appliances are running behind consumer demand after three full years of post-war production, T. J. Newcomb, sales manager of the Westinghouse electric appliance division, recently stated.

Mr Newcomb said that electric ranges and refrigerators did not have enough productive capacity to satisfy consumer wants, but explained that in the minor appliance group the problem was material shortages rather than capacity.

The supply lag has been overcome in automatic washers, electric clothes driers, irons, and vacuum cleaners, Mr

Silicone News

DC SILICONES

Invisible Servants

We're all kings with a house full of servants. They light the room as we walk into it. They freeze ice and preserve our food. They turn up the heat. They make music for us. They carry our voices thousands of miles in an instant. And we're so used to that kind of service that we take it for granted.

Most of us don't even know that those servants are cut down to the proper size by network transformers buried in vaults underground. That kind of service comes of making reliability a primary requirement in the choice of materials, in the designing and building and in the maintenance of electrical equipment.

PHOTO COURTESY WESTINGHOUSE ELECTRIC CORP.

New Westinghouse dry-type submersible network transformers are Silicone Insulated to provide maximum service, safety and reliability.

The announcement that Westinghouse Electric Corporation is now using Silicone Insulation to increase the reliability of network transformers is Silicone News of major significance. Their use of heat and moisture resistant DC Silicone varnishes makes it unnecessary to cool these transformers with inflammable oil.

Hence, the danger of fire and explosion are eliminated and fire-proof vaults are not required. Dry nitrogen filled and hermetically sealed, these transformers can operate even when submerged by flooding.

We have proved in our Motor Test Laboratory that Silicone (Class "H") Insulation has at least 10 times the life and 10 times the wet insulation resistance of conventional insulating materials under comparable service conditions. The introduction of silicone insulated transformers is further proof that Silicone Insulation is essential to maximum life and reliability in electrical equipment. For more information about DC 996 Silicone Electrical Insulating Varnish, write for pamphlet No. G7-AB.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

Atlanta • Chicago • Cleveland • Dallas
Los Angeles • New York
In Canada: Fiberglas Canada, Ltd., Toronto
In England: Albright and Wilson, Ltd., London

Dow Corning
FIRST IN SILICONES

MALLEABLE IRON *gives*

ALBION-DILLON ANCHORS

Lasting Strength

IMMEDIATE DELIVERY

R.E.A. APPROVED

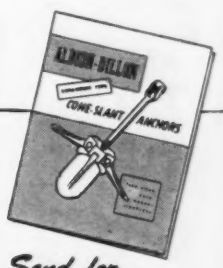
You can depend on Albion-Dillon Anchors for long, reliable service. For A-D Anchors are made from high-strength Malleable Iron, the material of high tensile strength, toughness and corrosion resistance. This means that A-D Anchors have *lasting strength*, an all-important feature.

This new R.E.A. approved expanding type anchor has three exceptionally long blades that dig into undisturbed earth—*and lock*, when fully extended—to provide maximum holding power.

Three sizes—3", 4" and 6", with two variations of blade spread available in the 6" size—are ready for *immediate delivery*. Rods are not supplied. Order through your distributor or write direct to us for specifications and prices.

A-D ANCHORS ARE EASILY INSTALLED

Blades are tied with a light wire to hold them together (see photo). A rod is attached and anchor dropped into hole dug to anchor size. A few blows on anchor top with spud will break wire and start blades digging in. Additional blows force blades deeply into solid earth until they're locked in open position.



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with specifications, illustrations and full information

ALBION MALLEABLE IRON CO.
"One of America's Foremost Producers of Malleable Iron"
ALBION, MICHIGAN

Opens Wide . . . Easily and speedily installed without removing nut, lock-washer and bolt.
Improved
ARMOR ROD CLAMPS
Clamp bodies are a special silicon aluminum alloy having exceptionally high tensile strength and corrosion resistance. No. R-101 has pure copper liner bonded by special process in small groove. Large groove for #6 to 1/0 ACSR over armor rods. Write for Bulletin No. 25 giving full data.
H. B. SHERMAN MFG. CO.
BATTLE CREEK, MICHIGAN
Unique, Interlocking Construction. Clamp automatically adjusts itself to fit all usual sizes of wire.

11 ~~10~~ REASONS
FOR USING HARPER
EVERLASTING FASTENINGS
1 Resistance to Rust and Corrosion
2 Resistance to High Temperatures
3 Non-Magnetic
4 Non-Sparking
5 Re-Useable
6 Attractive Appearance
7 Easy to Clean
8 High Strength
9 Long Life
10 Lower Ultimate Cost
11 RESISTANCE TO FATIGUE
—Only 1 Reason for using common steel
. . . LOWER FIRST COST!
PROMPT SHIPMENT FROM STOCK — Bolts, Nuts, Screws, Washers, Rivets, Accessories . . .
Harper maintains stocks of over 5,000 individual items in Chicago and New York . . . large quantities of each. Others being added constantly. Specials made to order from ample stocks of raw materials.
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BRANCH OFFICES: Atlanta, Cambridge, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Los Angeles, Milwaukee, Philadelphia, St. Louis, San Francisco, Seattle, Toronto (Canada).
HARPER'S 25th Anniversary
HARPER

Newcomb reported. He emphasized, however, that there were sections of the country where these items were still in short supply.

•

A. O. Smith Corp Expands Service Division Activities

Plans have been announced by the A. O. Smith Corp for construction of a 22,000-sq-ft building in Union Township, N. J., near Newark, which will be an expansion of the activity of the company's product service division in the east. The division, which has its headquarters in Chicago, started an eastern branch about a year ago in Newark. It also operates a branch in Los Angeles.

The division gives 24-hour off-the-shelf service on repairs and replacement parts for Smithway products, such as glass-lined water heaters, Burkay water heaters and heating systems, liquid gas systems, stokers, electric motors and pumps. It also carries on actual production operations in the repair of damaged products and parts, makes its own claim adjustments, provides field service and makes field surveys. John J. Bohmrich is manager of the division.

•

Manufacturers Make New Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

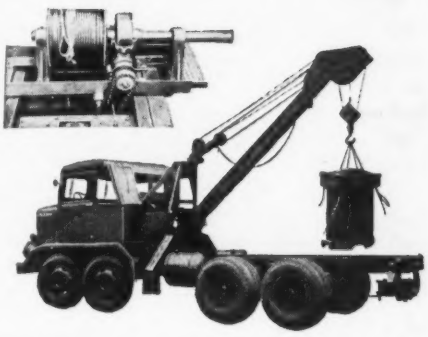
W. N. Matthews Corp, St. Louis, has appointed J. L. Finnicum of 4500 Euclid Av, Cleveland, as its sales representative in the northern two-thirds of Ohio, except Toledo. E. B. Rouzer, Plymouth Bldg, Minneapolis 2, Minn., has also been made sales representative. His territory will include North Dakota, South Dakota, Minnesota, and western Wisconsin. Harold C. Fiske continues to represent the corporation in Minneapolis and St. Paul.

Pacific Electric Manufacturing Corp has appointed the newly-formed Marrs & Wendegatz Co as its sales representative in the Kansas City area. L. G. Wendegatz has become a partner of A. A. Marrs, who has represented Pacific Electric in the area for 21 years.

Sterling Manufacturing Co, Cleveland, has appointed the Fostoria Industrial Service Co, 4500 Euclid Av, Cleveland, representatives. Sales territory will include northeastern Ohio. William L. Sayre of Daytona Beach has been named Florida representative and John R. Marvin of John R. Marvin & Co, 560 N. 16 St, Philadelphia, eastern representative. Mr Marvin's territory will include all of eastern Pennsylvania, including Altoona and southern New Jersey. The Corey Co, 81 Murray St, New York, has been appointed distributors. Sales territory will include the entire Metropolitan New York area.

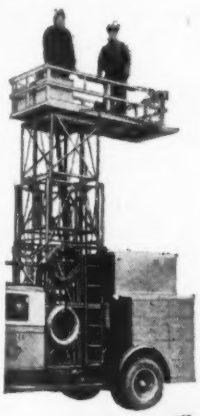
SILENT HOIST & CRANE CO.
Pioneer Mfrs. of Equipment For Public Utilities

KRANE KAR **Swing Boom Mobile Crane: for materials-handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 5 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.**



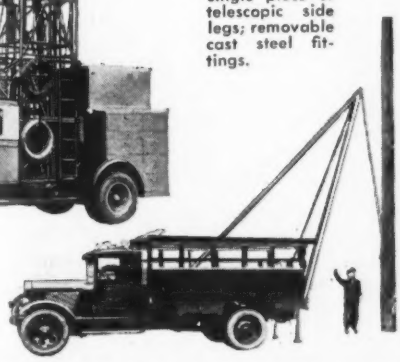
WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING BOOM CRANES: Truck: Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.



TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or racking platforms.

TRIPOD POLE DERRICKS: for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.



USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

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No. 79—KRANE KAR *No. 70—Truck Equipment*

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER

2½, 5, AND 10 TON CAPACITIES

KRANE KAR

TRADE MARK REGISTERED

SILENT HOIST & CRANE CO.
862-63rd ST., BROOKLYN 20, N. Y.

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Serving the utilities for a quarter of a century

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Quality Meter Testing and installation equipment

- Test Blocks
- Test Switches
- Special Switches
- Test Tables
- Safety Blocks
- Meter Enclosures
- Meter Connection Units
- Reactiformers
- Transformer Enclosures
- Accessories

SUPERIOR SWITCHBOARD & DEVICES CO.

CANTON 1, OHIO A subsidiary of The Union Metal Manufacturing Company

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

EVERSTICK ANCHORS

For new construction and maintenance — Everstick Anchors speed up work and provide dependable anchorage on all types of jobs. Made of resiliant, rust resistant malleable iron. The toughest anchors made. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

WHEN YOU PLAN POWER DAM PROJECTS
ASK US ABOUT
GATES & GATE HOISTS

Murray Gate Hoists are designed and built to meet all requirements . . . from the smallest hand operated to large motor operated—a wide range of capacities from less than 1 ton to over 100 tons. During our nearly half a century of designing and building gate hoists we have developed various designs for the different types of gate hoist problems. We feel sure we have designs and patterns that will fit your requirements.

We also build gate hoists entirely from your plans and specifications, if desired. In planning gates or gate hoists it is suggested you communicate with us before your plans for the project as a whole are completed . . . it will save expense and much preparation time.

Our engineering department is at your service any time to help solve problems involving this type of equipment.

MURCO
D. J. MURRAY MANUFACTURING CO.
WAUSAU WISCONSIN

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Alabama—Joe Wheeler Electric Membership Corp., Hartselle, 740 mi. rural distr. power lines and sys. imprvs., Morgan Co. **$1,985,000.** Lanier Eng. Co., Troy, consult. engr.

Arizona-Nevada — Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Yuma, Ariz., two 34,500-volt 600-ampere, 500,000-kva. interrupting rating, outdoor power circuit breakers, six 34,500-volt, 600-ampere, single-pole, single-throw, hook operated, outdoor disconnecting switches, each with hook-operated grounding blade, twelve 34,500-volt, 600-ampere, single-pole, single-throw, hook operated, outdoor disconnecting switches for addn. to Gila substation, Davis Dam Proj., Spec. 2478. Plans deposit $1.75. L. N. McClellan, ch. engr.

California—Bureau Reclamation, Dpt. Interior, Redding, completing Keswick Dam and Power Plant, Central Valley Proj., on Sacramento River, about 4 mi. north west of Redding, Spec. 2479.

Del., Smyrna—Town, electrical distr. sys., alterations, addns. J. C. Remington Jr. & J. J. Boyd, 503 Market St., Camden, N. J., consult. engrs.

Florida—U. S. Eng., P. O. Box 1169, Mobile, Zone 7, design, manufacture, test and del. f.o.b. railroad cars at Chattahoochee, three 11,111 kva. alternating-current generators and appurtenances for Jim Woodruff Dam, Apalachicola River, Inv. Eng-01-076-49-74. $1,000,000-$2,000,000.

Kansas—P. R. & W. Electric Co-operative, Wamego, 167.43 mi. rural distr. lines and conversion 25.5 mi., Pottawattamie, Geary and Wabaunsee Counties. $175,000. Frank Horton & Co., Lamar, Mo., engrs.

Kan., Kansas City—Bd. P. Utilities, light plant expan. **$5,865,000.** J. O. Armstrong, city engr.

Minn., Owatonna — City, P. Utilities Comn., G. P. Newhall, secy., municipal power bldg. addn. $85,000. Plans deposit $30. Pfeifer & Schultz, 702 Wesley Temple Bldg., Minneapolis, engrs.

Neb., Falls City—City, power plant and generating equip. imprvs. **$300,000.** Fulton & Cramer, 922 Trust Bldg., Lincoln, consult. engrs.

New Mexico—Socorro Electric Co-operative, Socorro, rural distr. lines, Socorro Co. **$190,000.**

North Carolina—Four County Electric Membership Corp., Burgaw, 151.5 mi. rural distr. lines, Bladen, Pender, Sampson and Duplin Counties. Plans deposit $25. L. E. Wooten & Assoc., 712 Capital Club Bldg., Raleigh, engrs.

Oregon—Bonneville Power Admin., 729 N.E. Oregon St., Portland, clearing 10.4 mi. right-of-way Suislaw River to Lane-Douglas Co. line on Mapleton-Reedsport 115 kv. transmission line, Lane Co., Inv. 4403. Plans deposit $25.

Pennsylvania — Bedford Rural Electric Co-operative, Bedford, 175 mi. rural distr. lines, sys. imprvs. and headquarters facilities, Bedford Co. **$400,000.**

Pa., Aspinwall—Aspinwall Boro B'dg., electric plant, remodeling and alterations to provide facilities for two 590 kw. gas diesel generators, roof repairs, River Ave. **$250,000.** Loftus Eng. Corp., 610 Smithfield St., Pittsburgh, consult. engr.

South Dakota—Black Hills Electric Co-operative, Custer, 157.5 mi. rural distr. lines, Custer Co. **$157,000.** Donald O. Flahart, Rapid City, consult. engr.

Tennessee—U. S. Eng., 303 U. S. Courthouse, Nashville, Zone 1, furnishing, del. f.o.b. railroad cars at Somerset, Ky. one 1,500 kva. water-wheel generator for station service unit at Wolf Creek Hydroelectric Power Plant, Serial No. Eng-10-058-49-44.

Washington—Bonneville Power Admin., 729 N.E. Oregon St., Portland, Ore., 19.42 mi. Scenic-Index sect. of Foster Creek-Snohomish 230 kv. transmission line, King

Business Studies of Industrials, Utilities and other Enterprises

Blueprint for Action

The best of business generals must hesitate when he has no clear picture of the strength and deployment of his forces, or the terrain and opposition to be encountered. At this moment, he can turn to EBASCO for the necessary information on which to base his tactics and strategy.

EBASCO Business Studies provide a sound factual basis as to business and earnings potentials. These Studies analyze:

- Organization and Personnel
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- Market Potential
- Sales and Distribution
- New Product Possibilities
- Competition
- Manufacture
- Cost Control System
- Production Control System
- Inventory Control System
- Insurance Programs
- Engineering
- Plant Location and Layout

Prepared by a staff of trained men, these Studies and accompanying reports furnish a comprehensive guide for planned management action.

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the worst fires start when your plant is unprotected!

Syracuse, Indiana — Trailer Mfg.
1 dead; $600,000

Fire, confined to a storeroom when discovered by the watchman, spread to stocks of paint and lumber in a large 1-story factory. A neighbor assisting firemen was trapped within the building.

Dee, Oregon — Warehouse
$205,000

Flames discovered coming from the roof of a large 1-story wooden warehouse by a watchman at 3:45 A. M. spread to 1,400,000 ft. of lumber stored in the yard of a nearby sawmill.

Marion, Ohio — Conveyor Mfg.
$350,000

Fire believed caused by a defective water cooler motor spread to painting material stores nearby. At 4:15 A.M., outsiders discovered the flames out of control in the large area 1-story building.

Reports of the National Fire Protection Association, month after month, show that the most costly fires start at night. The basis for this is logical; a small fire starts . . . there is no one there to spot it or to put it out . . . undetected, it grows rapidly . . . then the watchman, or often a passerby, discovers it . . . too late.

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and Snohomish Counties, Inv. 4407. Plans deposit $25.

Low Bidders & Contracts Awarded

Alabama—Southern Pine Electric Co-operative, Brewton, 101 mi. electric rural distr. line and sys. imprvs., to G. T. Key Co., 1212 S. Hall St., Montgomery. **$230,830.** Mowbray Eng. Co., Greenville, engr.

Kentucky—Jackson County Rural Electric Co-operative Corp., McKee, 169.8 mi. rural distr. lines, Jackson Co., to Shely Constr. Co., 809 Manchester St., Lexington, labor **$71,055,** materials **$109,000,** total $240,055. Blue Grass Engineers, Inc., 402 N. Limestone St., Lexington, engr.

Missouri—Cuivre River Electric Co-operative, J. W. Schaper, pres., Troy, Nov. 16, 271 mi. rural distr. lines, 33 mi. 3-phase, 220 mi. single phase and 18 mi. secondary lines, Proj. Missouri 57AB, Sect. IV Lincoln, Lincoln, St. Charles and Warren Counties, from Oil Field Electric Co., Carmi, Ill. **$142,282.**

Nebraska—Norris Rural P. Power Dist., Beatrice, 449.6 mi. rural distr. lines, Saline, Jefferson, Lancaster, Gage, Fillmore and Thayer Counties, to Hoak Constr. Co., P. O. Box 37, West Des Moines. **$505,915.** Bids 9/23.

Oklahoma — Verdigris Valley Electric Co-operative, Collinsville, labor for 197 mi. rural distr. lines Tulsa Co., to Berger Constr. Co., Higginsville, Mo. **$75,719.** Est. $75,000. Bids 9/16.

Oregon — Northern Wasco Co. Public Utility Dist., U. S. National Bank Bldg., The Dalles, rural distr. facilities, Wasco Co., to Montgomery Electric Co., 2375 N.W. Thurman St., Portland. **$80,396.** R. M. Kell, Equitable Bldg., Portland, engr.

Pa., Frugality—Altoona Coal & Coke Co., 123 S. Broad St., Phila., modernizing power plant. Owner builds. **$75,000.**

R. I., Providence—Narragansett Electric Co., 460 Eddy St., design and construction, 1 and 2 story oil pump house, junction bldg. and breaker unit for coal conveyor, Eddy St., to United Engineers & Constructors, Inc., 1401 Arch St., Phila., Pa. Est. **$115,000.**

Washington—Benton Rural Electric Assoc., Prosser, 191.2 mi. rural distr. lines, Benton Co., to Menzel & Kimball, Hotel Lorenz, Redding, Calif., labor **$114,652,** materials **$191,000,** total $305,652. Inland Eng. Co., Ritzville, engr.

Wisconsin—Barron County Electric Co-operative, Barron, 159.34 mi. rural distr. lines, Barron Co., to Hermans & Braatz, Schofield, labor **$57,588,** materials **$159,000,** total $216,588. Wisconsin Electric Co-operative, 303 E. Wilson St., Madison, Zone 3, engr.

Wis., Rice Lake—St. Josephs Hospital, Rice Lake, 1 story, bsmnt., rein.-con., brick, tile power plant and laundry, to Walter Butler Co., Inc., 1300 Minnesota Bldg., St. Paul, Minn. Est. **$100,000.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ariz., Phoenix—U. S. Eng., 751 S. Figueroa St., Los Angeles, plans by Samuel E. Lundeen, 400 Rowan Bldg., 4 story, rein.-con. main bldg. 150,000 sq. ft., plus dormitories, utility bldg., etc. **$4,000,000.**

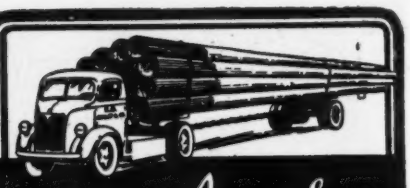
Mass., Arlington—Town, Housing Authority, W. D. Barker, chn., plans by Fay, Spoffard & Thorndike, archts., 11 Beacon St., Boston, and Harold C. Knight, consult. archt., 11 Beacon St., Boston, 173 dwelling units, Veterans Housing. **$1,728,587.**

O., Cleveland—St. Ann's Maternity Hospital, 3409 Woodland Ave., 6 story, 190x235 ft., brick, stone, steel, concrete maternity hospital, incl. penthouse for doctor's quarters, at East Blvd. and Fairhill Rd. $1,200,000. Plans deposit $100. Cutting & Ciresi, 2074 E. 36 St., archts.

Utah, Salt Lake City—Utah State Building Bd., Salt Lake City, plans by Ashton & Evans, 412 Beneficial Life Bldg., science bldg. for University of Utah. **$2,000,000.** Dr. Emile Waltzing, State Supervisor of Constr.

Low Bidders & Contracts Awarded

Colo., Grand Junction—Sisters of Charity, Bd. Control, Leavenworth, Kan., Nov. 16, 6 story, rein.-con., brick, stone 130-bed hospital, from Mesa Constr. Co., Grand Junction. **$1,758,871.**



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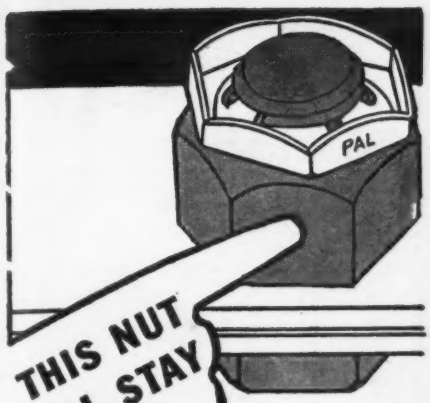

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because it is held with

PALNUT DOUBLE LOCKING ACTION*

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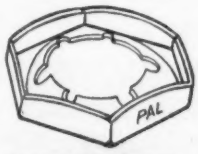

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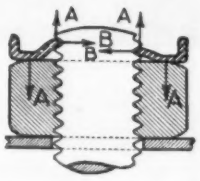

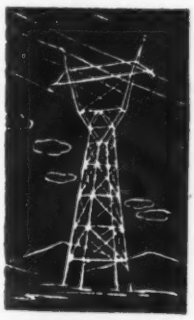

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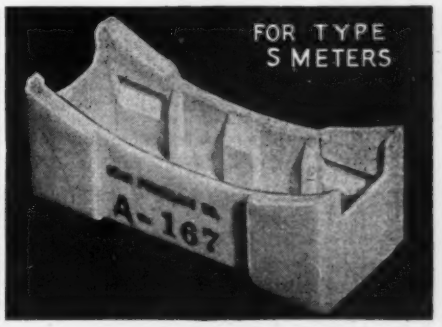

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RECENT RATE CHANGES

Iowa Public Service Co has increased its electric rates about 8%, starting with the November 2 readings. George A. Neal, president and general manager, said the company must have more revenue to keep up with higher cost of payrolls, taxes, fuel, and materials. The higher rates will affect 200 cities and towns in western and northern Iowa, including Waterloo, Carroll, and Audubon.

Northern States Power Co (Minn.) has been authorized by the state Public Service Commission to increase its electric and gas rates in Fargo and other North Dakota municipalities, effective with billings on and after Nov 1. Allen S. King, Fargo manager for the utility, said it was with considerable reluctance that the company reversed its long-time practice of reducing rates. "Rapidly rising production costs and the necessity insuring reliable service were the major reasons for the company request."

Detroit Edison Co's application to raise its rates $11,300,000 annually has been taken under advisement by the Michigan Public Service Commission. The utility urged that the additional revenue be raised partly by the "coal clause" and partly by reducing discounts for prompt payment of bills to 3% for all customers.

New York State Electric & Gas Corp has been granted permission by FPC to withdraw a proposed supplemental rate schedule for sale of electric energy to Pennsylvania Electric Co, an affiliate. Withdrawal of the schedule has terminated the proceedings.

Indiana & Michigan Electric Co and the Ft. Wayne city light and power municipal plant have filed jointly a petition to adjust the present residential water heating rate for the Ft. Wayne area. The only change will be the fixing of a definite number of kilowatt-hours per month for water heating at the present one-cent rate, with all electricity used for other purposes in excess of 180 kwhr per month billed at 1½ cents. Under the proposed adjustment, rates for the first two blocks of 60 and 120 kwhr each per month will not be changed. The adjustment will cause a small increase in the light bills of approximately 7% of City Light and Indiana & Michigan customers in the Ft. Wayne area.

Deepwater Light & Power Co, Philadelphia, has received FPC approval of its supplemental rate schedule, reducing rates and charges for electric energy sold at wholesale in interstate commerce to its parent company, Philadelphia Electric Co. The reduction became effective Oct 1. The new rate schedule will result in a reduction of $859,164 or 19% annually.

Community Public Service Co, which sells electric power in seven Kentucky cities, is seeking a rate-raising fuel clause. The company, a Texas corporation, has Kentucky headquarters in Walton. Inclusion of a fuel clause in the company's rates would increase its revenue $43,000 a year. The company serves a total of 8,867 residential and commercial customers. The increase would be levied against both types of customers.

ALL METAL
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DURABLE CONSTRUCTION
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Standard equipment with many electric service and telephone companies.
High visibility. 19" wide by 30" high. Folds compactly for storing. Double faced sign plate as illustrated.

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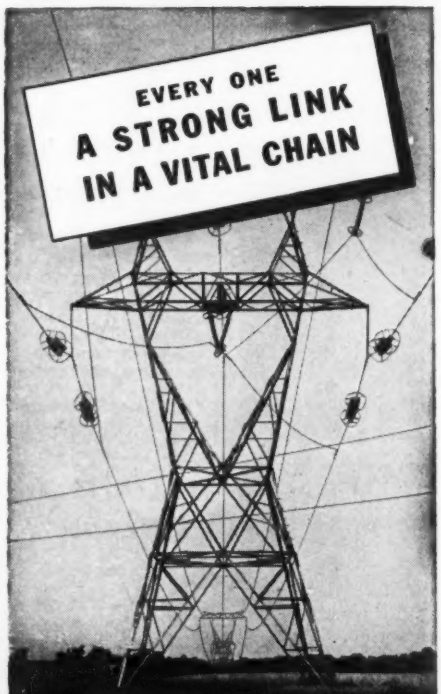

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Heavy Build-up with Dolph's Synthite PX-5 Black Baking Varnish

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A full five mil build-up with each coat of Synthite PX-5 . . . that's just one of the many reasons why Hanson-Van Winkle-Munning engineers prefer Dolph Black Baking Varnish.

Low-voltage motor generator sets built by Hanson-Van Winkle-Munning must withstand high ambient temperatures and high humidity, corrosive fumes and metallic dust naturally prevalent in electroplating and electrotyping plants.

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Why not let our Service Engineering Department study your production problems to give you the right insulating varnish for the job *you* have to do. They'll help put your treating cycle on a profitable basis, too. Write for our catalog or for technical assistance. John C. Dolph Co., 1062 Broad St., Newark, N. J.

Member Electrical Insulating Varnish Section, NEMA

Dolph's INSULATING VARNISH SPECIALISTS

Switched Capacitors

(*Continued from page* 87)

for factory-assembled, automatically-switched, 12-kv capacitors in standard units of reasonably small size and cost per kilovar.

To determine the size of the standard unit, quotations on various sizes are presented on the curve of Fig 3. This curve shows that the cost per kilovar rises rapidly below 800 kva per step. Analysis of the intended points of application showed that the voltage was changed 3% by the switching of something like 1,000 kva, although total amounts of 2,000 to 3,000 kva were required in many cases. These factors led to the selection of 3-step units of 2,700 kva, or 900 kva per step. Seventeen of these 3-step units were ordered.

Each 3-step unit consists of three almost identical outdoor sheet steel cubicles arranged side by side with aisles between. Knock-outs are provided for bushings in the roofs and cables in the floors. All three steps are controlled from one panel. Provision is made for starting with one step and adding the second and third later, as required. The units are completely automatic and are being installed at unattended locations.

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Switching is under the control of a combination of both voltage and time. The objective of a higher voltage "on peak" than "off peak" cannot be met with a voltage relay alone. Similarly, time control alone will not recognize abnormal voltage conditions. Accordingly, time switches with 7-day dials are provided to change the settings of the voltage relays a few percent at the beginning and ending of the heavy-load periods. To give further impetus to this action, each unit coming on or going off also changes the setting of the voltage relay automatically in anticipation of the next move.

A switched step of 900 kvar is about the smallest economical size of 12-kv capacitor with present switch prices. Still smaller sizes are desirable for application near the ends of long 12-kv feeders to keep voltage changes within set limits.

There is also a definite need for small 7.2-kv single-phase, automatically-switched capacitors, for application on rural feeders.

How to Solder Around Corners...and Between Wiring...

FLEXITIP—loop tip easily formed.
LONGER-REACH—8" from housing to tip: gives greater reach.
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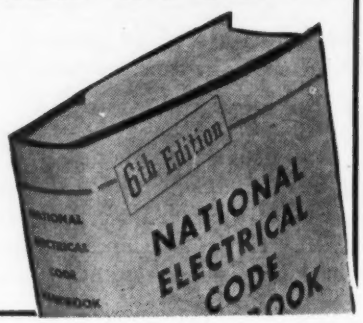

National Electrical Code Handbook

By Arthur L. Abbott

633 Pages, 5 x 7½, 418 illustrations, $4.00

This handbook is one of the most unusual and helpful electrical books published. It gives a wealth of information from the practical angle of getting jobs done according to code requirements. It saves delay in starting jobs, it saves time and money in avoiding false starts, errors and violations. At the same time, it contains so much clearly presented information that it will pay you to use it for general reference on many questions of material, plans, wiring, and installation.

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cable assemblies
raceways — requirements applying to all raceways
underplaster extensions
outlet, switch and junction boxes
switches — panelboards — switchboards
electrical appliances
motors—motor controllers
motor wiring and protection
generators — transformers — auto-transformers
capacitors—resistors and reactors — lightning arrestors — storage batteries
grounding
overcurrent protection
design of wiring installations—branch circuits — feeders and services
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—how to reduce wiring costs for ranges

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—how to install capacitors for power-factor correction

—how to protect transformers against overcurrent

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—how to form "stress cones" at cable terminations, etc.

All rules for a job grouped in one place

Once you have looked up a rule in this handbook, you may rest assured that you will not find later that there was another rule to be considered and that the job will have to be done over. It reduces a maze of scattered rules to a logical and understandable system.

It explains how the Code applies to:

- **commercial buildings**
- **homes**
- **factories**
- **theaters**
- **hazardous locations**
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LETTERS TO THE EDITOR

Municipal Utilities

To the Editor of ELECTRICAL WORLD:

Having been in the utility field for the past 25 years, 19 of which were spent with a private utility, I feel impelled to unload a few thoughts, and also feel that I know whereof I speak.

Your excellent magazine is more or less the "Bible" of the industry, and I trust it will continue to be so. However it seems to me that your continual hammering at public power could be qualified to a considerable extent. I might state at this point that I am entirely in agreement that we should not have socialized power and feel as you do that this would be the worst thing that could happen to our country.

Many Are 50 Years Old

However, I should like to refer you to Burns & McDonnell's *Results of Publicly Owned Electric Systems.* If you will check through this excellent report and disregard the TVA and the Northwestern section, I think you will find a good number of cities which have operated their own power systems for as long a time as the privately owned systems. I might refer you to a few in our own state of Michigan: Bay City, 51 years; Coldwater, 56 years; Detroit, 52 years, Escanaba 52 years; Grand Haven, 50 years; Holland, 53 years; Lansing, 54 years; Marquette, 58 years; Niles, 52 years; South Haven, 45 years.

These systems, as you may see, were started in the early days of the industry, are well run, and do some things that even the large private utilities are backward in adopting, and we do somewhat resent the implication when the private system advertise as "business managed utilities". I should very much like an opportunity to discuss with some of the large private utilities the reasons for the feelings against their operation.

Public Relations Are Important

I remember when rural lines were run only after customers first paid for the line or were charged large minimum payments, and then the uproar when REA started to come into the picture. The same thing is happening in some of the basin developments. At the present time the private utilities are passing up the finest opportunity they have ever had to improve relations with the municipal utilities in that they could, if offered on proper terms, sell capacity to these municipals and thus build up a fine load for future together with improving their public re-